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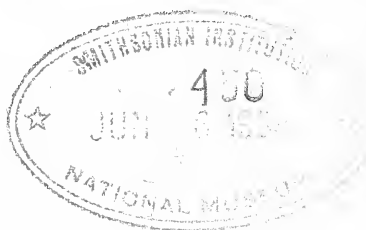
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DR. VICTOR STERKI

OBITUARY

DR. VICTOR STERKI

1846-1933

Another truly great scientist lives only in memory. Dr. Victor Sterki, known throughout the world for his work in Conchology and Protozoology, passed away on January twenty-fifth at his home in New Philadelphia, Ohio. He was in his eighty-seventh year.

Dr. Sterki was the son of Swiss parents, Anton and Magdalene Miller Sterki. He was born in Solothurn, Switzerland, on September 26, 1846. It was not until he was seven that he started to school. It was a country school, and his first classes were attended in the building in which his grandfather had taught for twenty-nine years. Later, after five years in the "gymnasium" or high school, he entered the University of Bern as a medical student. Before this time, however, his love of nature had been expressed in his many studies and collections of the native fauna and flora. Several diaries, written during those days, tell of his collections of plants and molluscs.

Dr. Sterki, in a letter found among his effects, gave a vivid picture of his experiences in school illustrating the severe educational methods of that early day. His description reads as follows: "When I was about your age, I was sent away to another school and this was the first time that I was really away from home. I went on October 7, 1864. It was, what is called a gymnasium, but rather 'narrow'; mainly intensive study of Latin, Greek, German, mathematics and history. There was nothing of the natural sciences, and this I greatly missed. Life there was as in a monastery; as strict as that. Each day saw us up at five in the morning, summer and winter, then study, then church, then breakfast; nine to eleven and one to four. School except one afternoon, and the balance of the time was spent in the 'study.' By this I mean, forty of us in one room, each with his little desk, elbow to elbow; we were forbidden to talk, even to whisper. At noon: eat, then one-half hour to church, prayer and the saying of psalms, etc., all in Latin. Then about one-half an hour out in the yard when the weather was good, and of course, freedom to talk. There was even one old dilapidated bowling alley, and in winter, a few times, there was war with snow-balls; that was the wildest of our life. After

the afternoon classes came supper, church and one-half to one hour recreation, bed at eight or nine. Even when going through the halls one was not permitted to talk to a fellow student that he passed.

"That year, with all of its drawbacks, may have had its advantage; it opened my eyes to many things and my naturally critical mind got food for thought—while I had, of course, to keep absolutely 'mum.' That I was actually a hypocrite can hardly be chalked up against me; I could not risk being expelled. I had been destined for the priesthood; my family thought that school was the place for me. It was; what had only been sprouting before came to maturity there. It turned me absolutely away from it—though it nearly broke my dear mother's heart."

Since that period in Dr. Sterki's life he turned his talents to his medical work and to his hobby, natural history. It is this part of the man that we know best and the part that has left its impression upon the world of knowledge and upon his host of friends and correspondents.

Young Victor Sterki was never a robust person, and at the end of his medical course was subjected to a long sickness which, as he told the writer, had stunted and maimed him physically.

The winter following his long illness was spent in Munich University studying the Protozoa, and in the spring of that year he took the examinations that would permit him to practice medicine. He did not obtain his M. D. degree until later.* After taking the examinations, which he passed with highest honor, he served as polyclinical, then as clinical assistant at the eye hospital of the University of Bern. Previous to this, while he was still attending his medical course, he had held the position of assistant of the Pathological Institute. This was in 1873, and in 1874, he went into practice for him-

*"In Switzerland, as well as in other European countries, the medical student has to pass a "State Examination" which entitles him to practice as a physician. This examination has nothing to do with the 'Doctor of Medicine' which is solely an academic degree, and involves not the right of practice. But most physicians graduate for the title; and the universities may, under circumstances, grant the 'M. D.' to an applicant, after he has passed the state examination satisfactorily, upon a good dissertation, and the fee required, without another formal examination. As Botany and Zoology, with comparative anatomy, are comprised in the (first or propaedeutic part of the) examination, a dissertation on such a subject could be accepted." These notes appeared in the introduction of Dr. Sterki's booklet written in 1895 and entitled, "Notes and Observations after twenty Years of Medical Practice in the Old and New World."

self. It had been his desire throughout his medical studies, to go as a ship's surgeon, but the offer and the acceptance of the work at the clinic stayed him. While holding these positions, he studied his beloved Infusoria, and in 1878, he received his degree of Doctor of Medicine upon a dissertation on the morphology of the *Oxytrichina*. This work was a classic in its field, and caused many of the prominent zoologists, and especially Bütschli to inquire of this young student and to commend him upon his very valuable addition to knowledge.

The year following his entry into practice, Dr. Sterki married Miss Mary Lanz of Huttwyl, Switzerland, and came to the United States in 1883. Settling in New Philadelphia, Ohio, to begin a medical practice in the New World, he was stimulated to greater efforts in the study of nature than ever before. First, he began a collection of minute gastropoda, and, after some years of work, this collection was purchased by the Carnegie Museum, where it now resides. In 1909, he was appointed Assistant in the Section of Recent Invertebrates (under Dr. A. E. Ortmann, Curator), a position he held (in absentia) until the time of his death. Since 1909, Dr. Sterki spent the majority of his spare hours upon his collection of *Sphæriidæ*. However, he found time for the study of Protozoa, Mosses, Land and Water Mollusca, and for working in his garden. His garden was as well described in his notes as are some of his shells. Hardly a period of fluctuation in his surroundings missed his notice.

Here, surrounded by the many cases of shells, fossils, and his library of more than a thousand pamphlets and bound volumes, one sees more of the true lover of nature than of the medical practitioner. Truly it seems the routine of practice irked him; lent itself as a stimulus to scientific research instead of a hindrance. Dr. Sterki was an earnest student of molluscs throughout his life. My own friendship with him during the last three years leads me to characterize him as a man of very genial and hospitable manners, always agreeable and unpretentious. The world has lost a great collector and an untiring student as well as a friendly, helpful man. He is survived by two daughters, Mrs. Bertha Medley and Mrs. Fanny Cavanaugh and a son, Walter. One daughter, Mrs. Beatrice Parr, died in December of this past year, seemingly precipitating her father's end.

The collection of *Sphæriidæ*, numbering over twelve thousand identified and catalogued lots resides in the laboratory of Recent Invertebrates of the Carnegie Museum along with his collection of

Pupillidæ and numerous other collections from America and elsewhere.

However, the collections made by Dr. Sterki cover more than just the minute mussels, the *Sphæriidæ*, as the Herbarium contains over one hundred and fifty botanical specimens, mainly mosses and ferns.

The Library of the Carnegie Museum has been enriched by over two hundred and seventy-five bound and unbound volumes, and over one thousand, five hundred pamphlets. Many of these are valuable to the investigator and constitute a much sought-for addition to our working library. The published articles from Dr. Sterki's own pen number some one hundred and fifty-one.

The collection of minute gastropoda, which has resided in the Museum since 1909, is composed of nearly four thousand "lots." This forms a collection of many thousands of specimens. His remaining collection of gastropoda and pelecypoda, which was obtained by this Museum at Dr. Sterki's death, will undoubtedly number some hundreds of thousands of specimens, and it includes material from many very valuable exchanges with European museums and specialists. A few fossils collected during his youthful expeditions into the Swiss Alps constituted the least valuable and the smallest part of his extensive interests.

The collection of minute pelecypoda, the *Sphæriidæ*, is the crowning success of Dr. Sterki's long and useful life. It numbers over twelve thousand "lots" of shells. It has been estimated by him to contain between five hundred thousand and nine hundred thousand specimens. This collection is unique in that out of over two hundred and fifty species so far catalogued by the writer there have been over one hundred and fifty described and named by Dr. Sterki. In the twenty-five note-books kept by him over a period of more than thirty years are many unpublished descriptions of new species as well as voluminous notes on his own and other's species.

Dr. Sterki was the authority in his field; the one that held within his greying head the greatest part of the knowledge of this interesting and difficult animal group. It is now for the younger students to carry-on and build from his amassed data a suitable and living monument to a life not wasted. *The Monograph of the Sphæriidæ of the World*, the work upon which his life was spent is yet to appear. It is the fond hope of the writer that this great effort will see the light of day through the efforts of this laboratory.

STANLEY T. BROOKS, *Curator, Section of Recent Invertebrates.*

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*This is as complete as it can possibly be made at the present; Dr. Sterki leaving no bibliography.

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OLOF AUGUST PETERSON

OBITUARY

OLOF AUGUST PETERSON.

January 2, 1865—November 12, 1933.

Mr. O. A. Peterson, Curator of Vertebrate Paleontology in the Carnegie Museum, died at his home at Bradford Woods, Pennsylvania, near Pittsburgh, on Sunday evening, November 12, 1933, after a long illness. He is survived by his widow, Mrs. Eda Hermann Peterson.

Mr. Peterson was born at Hellgum and Rådom, Vestmorlands Län, Sweden, on January 2, 1865. In his boyhood he attended the public schools near his birthplace and when he was a lad of seventeen came with his parents to this country. His father settled as a farmer in the West, and here young Peterson found employment in various occupations. He labored part of the time as an agriculturist and part of the time as a cattle-man in Wyoming, becoming familiar with the free and open life of the western ranchmen. In 1888 he was engaged by Mr. John B. Hatcher as an assistant in collecting fossils in Nebraska and Wyoming for the late Professor Othniel C. Marsh of Yale University. Mr. Hatcher had in 1887 married a sister of Mr. Peterson. When the work in the field which was being carried on by Mr. Hatcher terminated with the advent of cold weather at the beginning of the winter of 1888, Mr. Peterson came east to New Haven, and was employed in the laboratory of the Peabody Museum in helping to prepare for study the specimens which had been collected. This event marked his initiation into a branch of science which brought to him a wide and well deserved recognition among the paleontologists of this country. From the winter of 1888 until the fall of 1891 he was regularly engaged either in the Museum at Yale or in the field as one of the assistants of Professor O. C. Marsh, working under the general direction of Mr. Hatcher. In 1891 he was appointed to a position carrying similar duties under Professor Henry Fairfield Osborn in the American Museum of Natural History in New York City, where he remained for five years. During this period he was frequently sent to the fossil-fields of the Western Territories and States and made large collections for the American Museum of Natural History. It was through his efforts that the latter institution obtained the larger part of the material representing the Eocene deposits of Utah, which

are so rich in the remains of the early mammalian life of this continent. His work, carried on in the reservations of the Uncompahgre and Ute Indians, was attended with much hardship and some risk.

After having spent five years in the employment of the American Museum, he joined the first expedition which was sent by Princeton University to Patagonia under the leadership of Mr. Hatcher. Both Mr. Hatcher and Mr. Peterson on the occasion of this memorable exploration were for long periods of time without sight of any other human beings and penetrated into parts of the land even the general topography of which was unknown at that time, except in a most imperfect manner. They discovered various lakes and rivers which had not been mapped heretofore. The first Princeton Expedition returned to New York laden with scientific treasures, and Mr. Peterson remained at Princeton in order to free from the matrix portions of the material collected, while Mr. Hatcher returned upon his second expedition, during which he very nearly lost his life. Not daunted, however, by the trying experiences through which he had passed, Mr. Hatcher undertook a third expedition, and sailed on December 9, 1898, one month after his return from the second expedition, being accompanied on this venture, which was his final journey to Patagonia, by Mr. Peterson and Mr. Barnum Brown.

Shortly after returning from the third Princeton expedition to Patagonia, Mr. Peterson was induced in January, 1900, to enter into the employment of the Carnegie Museum as a Collector and Assistant in the Section of Paleontology. Dr. Holland, the Director of the Carnegie Museum, who was keenly interested in pursuing thorough explorations in this field, found in the person of Mr. Peterson a collaborator of excellent qualifications. At the time when Mr. Peterson first came into the employment of the Museum, the Section of Paleontology was under the care of Dr. Jacob L. Wortman, who was succeeded in the spring of 1900 by Professor John B. Hatcher of Princeton. In the wonderful work which was done in the domain of paleontology in the Museum under Dr. Holland and Professor Hatcher, Mr. Peterson played a very prominent part, by his activities both in the field and in the laboratory. His first work for the Carnegie Museum in the field was in connection with the recovery of the remains of the colossal *Diplodocus*, which had been partially unearthed in the fall of the year 1899. The work of superintending the removal of the remainder of the skeleton was entrusted by Dr. Holland to Mr. Peterson under the

general oversight of Mr. Hatcher. These activities were followed by the explorations which he carried on in eastern Wyoming and in Nebraska, in the lower Miocene beds, principally of Sioux County, Nebraska. No collection from these beds of equal value and importance had ever previously been made. Among the great extinct mammals, for a knowledge of the anatomy of which we are indebted to the discoveries of Mr. Peterson, may be mentioned the colossal pig-like mammal known as *Dinohyus*; *Moropus*; the diminutive camels; the pair-horned rhinoceroses; the saber-toothed cats; *Daphænodon*, the ancestor of the dogs of today; the diminutive three-toed horses; and the remarkable extinct family of the *Merycoidodonts*—all magnificently represented in the collections made by Mr. Peterson in Nebraska. Much of the material exceeds in the perfection of its preservation any other material which has as yet been discovered.

Having spent a sufficient time in the exploration of the fossil beds of Nebraska and South Dakota, Mr. Peterson resumed his investigations in the Uinta beds of Utah, in which he had collected many years before for the American Museum. Here he was again most remarkably successful in discovering a quantity of significant remains which threw a novel light upon the evolution of animal life in the new world. Through the skill of Mr. Peterson and his associate, Professor Earl Douglass, a strange fauna was unearthed in the arid bad-lands which lay buried on either side of the Green River above the point where it joins the Grand to carve out the great cañon of the Colorado. In recent times Mr. Peterson paid special attention to the exploration of certain horizons in the Uinta formation, which yielded remarkable new discoveries, notably among the titanotheres, and a number of other extinct mammals.

Mr. Peterson published a number of papers which have appeared in the *Annals and Memoirs of the Carnegie Museum* as well as in other periodicals, and still others are in course of publication. A list of his publications is appended to this biographical sketch. His papers relate more especially to the fossil mammalia of the Western States and Territories which were chiefly the field of his research. He collaborated with Dr. W. J. Holland in the production of the great Memoir published in December 1913 by the Carnegie Museum upon "The Osteology of *Moropus*."

Various notes found among papers of the late W. J. Holland were perused in the preparation of this outline of the life and attainments of

his distinguished associate who accomplished so much for the enduring prestige of the Carnegie Museum which they both served so faithfully. Mr. Peterson was a member of the Geological Society of America, the American Association for the Advancement of Science, the American Association of Museums, and the Academy of Science and Art of Pittsburgh. The American Museum of Natural History paid him recently a befitting compliment by placing his name on a special bronze tablet erected at the entrance to the Hall of the Age of Mammals, commemorating for perpetuity the most outstanding American Paleontologists.

Mr. Peterson endeared himself to all his associates and colleagues at the Carnegie Museum, and his numerous friends in this community and in various scientific institutions through the country. He was universally beloved for his kindly disposition, his affable attitude to all those who were seeking his advice and help, and for his sterling personality. His scientific knowledge was wide and thorough, but his modesty was just as distinctive and genuine. He had the grace of bearing his knowledge lightly without the slightest trace of ostentation. The memory of the late O. A. Peterson will live as a radiant image in the hearts of his friends, and the monument he has erected to his scientific name will never perish within the domains of human knowledge.

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ERRATA AND CORRIGENDA

- p. 42. 4th line from bottom, for *guajava* read *Guajava*.
- p. 86. 5th line from top, for **phyllitides** read **phyllitidis**.
6th line from top, for *Campylonerum phyllitides* read *Campyloneurum phyllitidis*.
- pp. 92, 95, 96, 98, 99, 106, 108, 116, 124, 131, 139, 142, 143, 159, 176, 183, 201, 203, for Humbolt read Humboldt.
- p. 96. 17th line from bottom, for **lacryma-jobi** read **Lacryma-Jobi**.
- p. 108. 2nd line from top, after **Maximiliana**, insert **regia** Martius.
- p. 114. 10th line from top, after **diversifolia**, insert (Vahl).
- p. 116. 4th line from top, for *amancæs* read *Amancæs*.
- p. 133. 9th line from top, for Long-john read Long-John.
- p. 150. 8th line from bottom, after **bifolium**, insert (Aublet).
- p. 154. 4th line from top, after **barbatum**, insert (Linnæus).
6th line from bottom, for JIQUIRITY read JEQUIRITY.
5th line from bottom, for *abrus* read *Abrus*.
- p. 162. 3rd line from top, for **paræense** read **paraëense**.
- p. 164. 12th line from bottom, after **guianense**, insert (Aublet).
- p. 168. 11th line from bottom, after **puberum**, insert (L. Richard).
- p. 169. 15th line from top, delete (DeCandolle).
- p. 186. 13th line from bottom, for **sabdariffa** read **Sabdariffa**.
- p. 194. 8th line from top, after **punctata**, insert (Aublet).
- p. 207. 15th line from bottom, for **guajava** read **Guajava**.
- p. 314. 3d line from bottom, for *cautis* read *caulis*.
- p. 353. Text figure should be reversed.

I. THE REPTILES OF THE PULITZER ANGOLA EXPEDITION.

BY KARL PATTERSON SCHMIDT, ASSISTANT CURATOR OF REPTILES,
FIELD MUSEUM OF NATURAL HISTORY.

(PLATES I AND II)

INTRODUCTION.

The Pulitzer Angola Expedition in 1930 and 1931 was primarily interested in the collecting of mammals and birds. Due to the interest of the several members of the party, Mr. and Mrs. Ralph Pulitzer and Mr. and Mrs. Rudyerd Boulton, a considerable number of reptiles were collected and preserved, and these include important additions to our knowledge of the Angolan herpetological fauna. At the instance of Mr. and Mrs. Boulton and of Mr. M. Graham Netting, Curator of Herpetology at the Carnegie Museum, this collection, amounting to 457 specimens, has been loaned to me for study, and I have drawn up the present report upon it. Field Museum retains a series of duplicates, which forms an important addition to its collections of African reptiles.

The collecting stations mentioned in the present report are located on the accompanying map (fig. 1). They are few but are so distributed that there are two in the desert region of Mossamedes, two in the dry savanna of southern Angola, and two in the more humid high-grass region of the central part of the country.

The proportion of endemic forms in the herpetological fauna of Angola is considerable; and as little attention has been paid to it since the publication of the "Herpetologie d' Angola et du Congo" by Bocage, in 1895, it is not surprising that the present collection should contain a number of new species and subspecies. The new forms here described are:

Rhoptropus boultoni
Pachydactylus bibronii pulitseræ
Lygodactylus lauræ
Varanus albigularis angolensis

I have reduced bibliographic references in the following list to a minimum, and have avoided changes in current nomenclature, in view

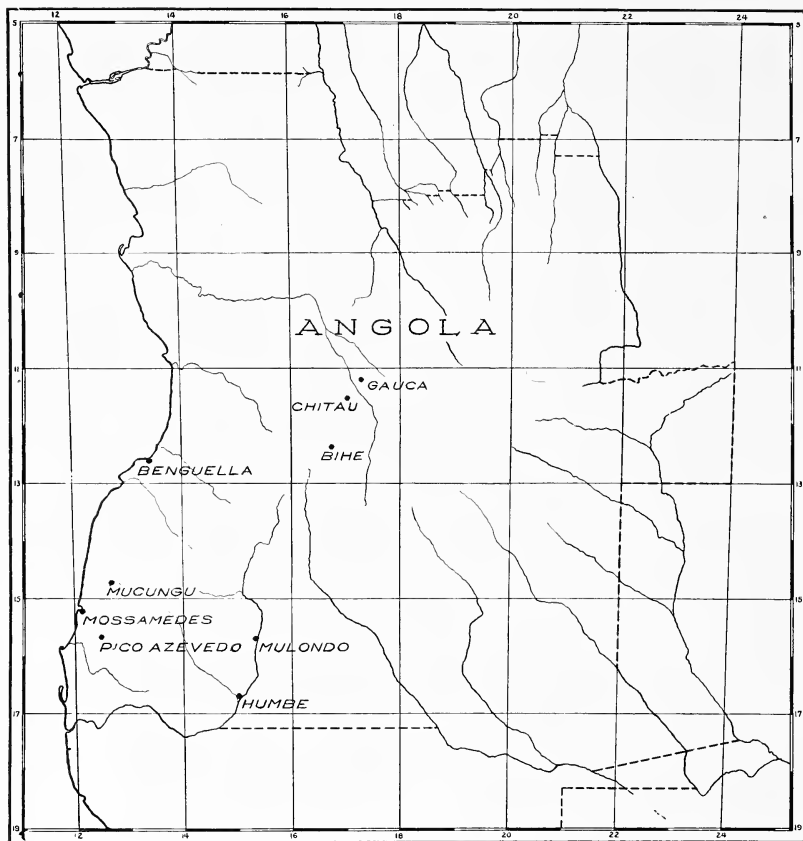


FIG. 1. Map of Angola to show collecting stations, for reptiles, of the Pulitzer Angola Expedition.

of the fact that more comprehensive reports on Angolan herpetology, based on the collections of the Vernay Angolan Expedition in the American Museum of Natural History, are awaited.

The grant of a Guggenheim Fellowship in 1932 enabled me to visit European Museums where, though engaged primarily on other studies, I was able to examine specimens of the genus *Rhoptropus* in the British Museum of Natural History and the Zoologisches Museum of Berlin. My thanks are due to the authorities of these institutions and, especially, to Mr. H. W. Parker at the British Museum and to Dr. Ernst Ahl in Berlin. I am indebted to Mr. Arthur Loveridge, of the Museum of Comparative Zoology, for information on specimens in

his charge; and I have had the advantage, in the preparation of the present report, that the entire African collection of reptiles and amphibians in Field Museum of Natural History has recently passed through Mr. Loveridge's hands for identification or verification of identification.

TESTUDINATA.

1. *Pelomedusa galeata* (Schoepff)

Testudo galeata SCHOEPFF, 1792, Hist. Testud., 12, pl. 3, fig. 1.

Pelomedusa galeata WAGLER, 1830, Syst. Amphib., pl. 2, figs. 36-38.

Six specimens, C. M. Nos. 5964-66, Mucungu; 5969, 5972, Chitau, Jan. 16, 1931; 5973, Gauca, Jan. 10, 1931.

One of these specimens, No. 5972, is a hatchling, with the umbilical scar not yet closed, though the egg-tooth is lost. Its shell measures 25.0 mm. by 19.5 mm. The costal and neural plates are sharply rugose, the marginals and plastrals smooth. The central two-thirds of the plastron is black. No. 5964, with a shell 52.4 x 43.3 mm., appears to be in its second year, but obscure grooves are distinguishable on the plates of the carapace. No. 5969, measuring 91.9 x 72.1 mm., has three sharply defined growth rings, but has also indications of additional rings. Age determination of turtles from the tropics by means of the growth rings appears to be less certain than in turtles of temperate latitudes. In No. 5973, 118.9 x 91.0 mm., the plates are nearly smooth, with growth rings as well as striation almost erased.

2. *Pelusios derbianus* (Gray)

Sternotherus derbianus GRAY, 1844, Cat. Tortoises, 37.

A single specimen, C. M. No. 5970, was collected at Chitau, Jan. 16, 1931.

This specimen, with six growth rings, measures 103.6 x 72.1 mm. in length and breadth of carapace. The plastron is almost entirely yellow, only the portions of the pectoral and abdominal shields which enter the bridge and the small gulars are black.

3. *Pelusios sinuatus sinuatus* (Smith)

Sternotherus sinuatus SMITH, 1838, Ill. Zool. S. Africa, 3, pl. 1.

A single specimen, C. M. No. 5971, was collected at Chitau, Jan. 16, 1931.

This specimen, whose shell measures 150.0 x 100.0 mm., differs from the specimen listed as *derbianus* above in having proportionately larger abdominal shields, plastron completely black, and a bicuspid beak. There are ten or eleven growth rings.

The trinomial is necessitated by the description of *Pelusios sinuatus zuluensis* Hewitt, 1927.

4. *Kinixys belliana* Gray

Kinixys belliana GRAY, 1831, Synopsis Rept., 69.

Four specimens, No. 5968, Chitau, Jan. 16, 1931; and 5974-76, Gauca, Jan. 8-10, 1931.

No. 5975, apparently in its second year, measures 73.3 mm. x 61.8 mm. The carapacial hinge has not appeared. In the three larger specimens the amount of black pigment in the horny shields is variable. The shell of the largest specimen, No. 5968, measures 197 x 128 mm. No. 5974 has a tick attached at the hinge on one side, while No. 5976 has a tick at this place on each side.

SAURIA.

5. *Hemidactylus longicephalus* Bocage

Hemidactylus longicephalus BOCAGE, 1873, Journ. Sci. Lisboa, 4, 210.

Two specimens, C. M. Nos. 5724 and 5932, from Gauca, Jan. 8-10, 1931.

6. *Lygodactylus capensis capensis* (Smith)

Hemidactylus capensis SMITH, 1838, Ill. Zool. S. Africa, 3, pl. 75, fig. 3.

Two specimens, C. M. Nos. 5649-50, collected at Mucungu. The pale coloration of these specimens and the irregularly enlarged subcaudal scales of No. 5649 (the tail being lost in the second specimen) suggest that an Angolan race of *L. capensis* may be distinguishable when sufficient material is examined. Both of these specimens have the five preanal pores normal for *capensis*.

7. *Lygodactylus lauræ*, sp. nov.

Type.—Carnegie Museum No. 5860, collected at Chitau, Bihe District, January 12, 1931, by Rudyerd and Laura Boulton.

Diagnosis.—Allied to *Lygodactylus capensis* in having the mental plate 3-lobed; distinguished by larger scales on the under surfaces of the thighs, and preanal pores 9 to 10 instead of 5.

Description of type.—Body slightly depressed, snout pointed; mental 3-lobed; upper labials 8, lower labials 6; the anterior of the two scales above the nostril larger; scales of under side of tail irregularly enlarged but no enlarged median series; preanal pores 9; dark gray above, with obscure darker vermiculation, pale beneath (in formalin specimens).

Paratypes.—C. M. Nos. 5861-62, collected at Chitau, Jan. 12, 1931, and Nos. 5933-34, from Gauca, Bihe District, Jan. 8, 1931, are in excellent agreement with the type.

Remarks.—Bocage notes a specimen from Cahata, collected by Anchieta, with 9 preanal pores which, therefore, clearly belongs to this form, among the series referred by himself to *Lygodactylus capensis*.

8. *Pachydactylus punctatus brunnthaleri* Werner

Pachydactylus brunnthaleri WERNER, 1913, Denkschr. Akad. Wiss. Wien, **88**, 718.

Pachydactylus punctatus brunnthaleri HEWITT, 1926, Ann. S. African Mus., **20**, 478.

A single specimen, C. M. 5618 from Pico Azevedo, is referred to this species on account of its complete agreement with the supplementary description of Werner in his account of the Reptilia and Amphibia in Michaelsen's "Beitrage zur Kenntniss der Land- und Süsswasser fauna Deutsch-Südwestafrikas," 1915. The type locality is Buluwayo, South Rhodesia.

9. *Pachydactylus laevigatus* Fischer (Plate I)

Pachydactylus laevigatus FISCHER, 1888, Jahrb. Hamb. Wiss. Anst., **5**, 15, pl. 2, fig. 3.

Two specimens, C. M. Nos. 5621 and 5623, from Pico Azevedo have the flat unkeeled tubercles of this species. On account of its occurrence with *P. bibronii*, and with the subspecies of *P. bibronii* described below as its representative in Angola, it does not seem likely that *laevigatus* is to be regarded as a subspecies of *bibronii*.

10. *Pachydactylus stellatus* Werner

Pachydactylus bibronii var. *stellata* WERNER, 1909, Denkschr. Jena, **16**, 308.

Two specimens, C. M. 5647 and 5961, collected at Mulondo, November 18 and 25, 1930, agree in having much more stellate tubercles

on the head and back than is the case with *P. bibronii* from Cape Colony and the Bechuanaland Protectorate, and are in the same way distinct from *P. bibronii pulitzeræ*. I am unable to understand its distribution on the hypothesis that it is a subspecies of *bibronii*. Obviously a distributional study and revision of the genus *Pachydactylus* would be productive of results of the greatest interest.

11. ***Pachydactylus bibronii pulitzeræ***, subsp. nov. (Plate I)

Type.—Carnegie Museum No. 5619, Oct. 9, 1930, collected at Pico Azevedo by Rudyerd and Laura Boulton.

Diagnosis.—Larger and less strongly tuberculate than *Pachydactylus bibronii bibronii*; occipital area almost smooth, covered with flat tubercles.

Description of type.—Habitus stout, limbs short, head broad and triangular; postnasal and frontal hollows distinct; ear opening about half as wide as high; three prominent, laterally directed tubercles in front of ear; upper labials eleven, lower labials nine; mental elongate, slightly longer and narrower than the adjacent lower labials; ten lamellæ on the third toe and on the third finger; dorsal tubercles sharply keeled, in sixteen straight longitudinal rows, the vertebral line with a double row of much smaller ones; middle of head behind eyes almost entirely smooth, without keeled or stellate tubercles; three strong laterally directed tubercles at the base of the tail on each side. Brownish gray above, paler beneath; scattered, sharply defined, white spots, mostly on single tubercles on the back; on the shoulders these are grouped on a black horseshoe which extends from one arm to the other, the most prominent white spots being above the insertion of the arm.

Paratypes.—C. M. Nos. 5620, 5622, from the type locality, agree excellently with the type in structure, but lack the conspicuous white spots, which are perhaps characteristic of the coloration of the breeding male.

Remarks.—The smooth non-tuberculate crown of this form is not approached among the twenty-eight specimens of *P. bibronii bibronii* available for comparison with the Angolan material. These come from various localities in the Bechuanaland Protectorate, collected for Field Museum by the Vernay-Lang Kalahari Expedition.

12. ***Rhoptropus barnardi*** Hewitt (Fig 2 and Plate I)

Rhoptropus barnardi HEWITT, Ann. S. African Mus., 20, 413, pl. 35.

Four specimens, C. M. Nos. 5651-5654, from Mucungu agree with the description and figures of *R. barnardi*, the type locality of which

is Eriksson's Drift, on the Cunene River, *i.e.* near the Angolan border of Southwest Africa.

These specimens have a row of enlarged chin shields adjacent to the anterior lower labials and mental, and a single scale between the characteristically swollen nasals. Three are pale gray with five transverse rows of black spots, four spots in each row, while the fourth specimen has only the spots above the shoulder.

In the two cotypes of *Rhoptropus afer* in the Zoologisches Museum in Berlin, from Damaraland, there are no enlarged chin shields, three scales between the nasals, and scattered smaller black spots, not arranged in transverse series. Two additional specimens from Damaraland, one in the British Museum and one in the Senckenbergisches Museum in Frankfurt-a-M., agree completely with the cotypes and thus differ from *barnardi*.

Six additional specimens of *Rhoptropus barnardi* in the British Museum come from Mossamedes, Mossamedes District, and from Manconjo and Huxe Sierra, Benguela District. Still another specimen in the Zoologisches Museum agrees with *barnardi* and comes from Biballa, Benguela. These are all like *barnardi* in the presence of a row of small but distinct chin shields. Six of these specimens are colored essentially like the Mucungu specimens; the seventh (from Mossamedes) has small scattered black spots like *afer*, but as it agrees with the other Angolan specimens in the presence of enlarged chin shields, it cannot be regarded as anything but *barnardi*. *Rhoptropus afer* remains little known, and an adequate series of this species is necessary to clear up its exact relations with *barnardi*.

13. *Rhoptropus boultoni*, sp. nov. (Fig. 2 and Plate I.)

Type.—Carnegie Museum No. 5634, ♂, collected at Pico Azevedo, Mossamedes, Oct. 9, 1930, by Rudyerd and Laura Boulton.

Diagnosis.—Digits and swollen nostrils and uniform lepidosis of *Rhoptropus*; distinguished from *barnardi* and *afer* by larger size, dark coloration, larger number of lower labials, and strap-shaped instead of wedge-shaped first lower labial.

Description of type.—Head pointed ovate, limbs long; dorsal scales uniformly granular, a little larger and flatter on the snout; ventral scales flat, scarcely imbricate; swollen nostrils separated by a single scale; upper labials 12-13, lower labials 8-8; lamellæ beneath the third finger 11+9, beneath the fourth toe 13+9; anterior lower labials remarkably elongate, strap-shaped, bordered by a distinct series of

chin shields; tail verticillate at base, the verticils three scales long at base, with no transverse median scales on the first five verticils; beyond this there are enlarged and transversely widened scales on the under side of the tail to the tip, with no evidence that any portion of it is reproduced; five preanal pores; coloration dark gray, with obscure clouded markings, limbs lighter.

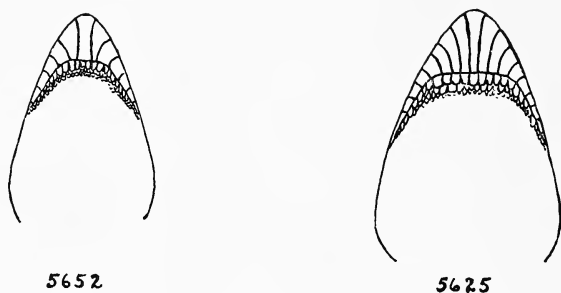


FIG. 2. Lower labials and chin shields of *Rhoptropus barnardi* (left), compared with *Rhoptropus boultoni* (right). ($\times 1\frac{1}{2}$).

Measurements.—Length 133 mm.; body 66 mm.; hind limb 33 mm.; forelimb 24 mm.; snout to posterior border of ear 18 mm.; width of head 14 mm.; knee to knee 37 mm.

Paratypes.—Carnegie Museum Nos. 5624-33 and 5635-46, all from Pico Azevedo, agree so closely that it is clear that *Rhoptropus boultoni* is a species fully distinct from *R. barnardi*, which is found on all sides of Pico Azevedo. The only clue to a difference in habits or to habitat association which would account for the existence of so closely allied a form within the range of its congener, lies in the fact that at Pico Azevedo outcrops of rock appear in the otherwise uniform sand and scrub desert. It is likely, therefore, that *Rhoptropus boultoni* lives in rock crevices or beneath boulders and has thus been isolated ecologically from *Rhoptropus barnardi*.

Remarks.—The genus *Rhoptropus* was originally monotypic, with *Rhoptropus afer* Peters, 1869, as the only species. In 1885 Boulenger described *Rhoptropus ocellatus*, from Capetown, and this species was rediscovered by Prof. Max Weber at Klipfontein, Little Namaqualand, and remarked upon by Roux (1907, Zool. Jahrb. Syst., 25, 412). Roux proposes, tentatively, that *Rhoptropus* should be united with *Phelsuma* on account of the general agreement of *R. ocellatus* with that genus. Examination of the type of *R. ocellatus* in the British Museum quite justifies Roux's remarks, for it must unquestionably be trans-

ferred to *Phelsuma*; but this has nothing to do with the validity of *Rhoptropus*, which is amply distinguished by its vertical pupils, swollen nasals with nostrils separated from rostral and labials, greatly elongate lower labials, short series of preanal pores, and other characters. Boulenger's reference of *Dactychilikion braconieri* to the synonymy of *Rhoptropus afer* is questioned by Hewitt, who regards *braconieri* as a valid species of *Rhoptropus*; it may be so retained until its relations can be cleared up by means of further material. Eliminating *Phelsuma ocellata* (Boulenger), the species of *Rhoptropus* are:

Rhoptropus afer Peters, type locality Damaraland.

Rhoptropus braconieri Thomassin, type locality Lake Ngami, Bechuanaland Protectorate.

Rhoptropus barnardi Hewitt, type locality Eriksson's Drift, Cunene River, South West Africa.

Rhoptropus boultoni, sp. nov., type locality Pico Azevedo, Mosamedes, Angola.

14. *Agama planiceps* Peters

Agama planiceps PETERS, 1862, Monatsber. Akad. Wiss. Berlin, 1862, 15.

One specimen, C. M. No. 5617, from Pico Azevedo, Oct. 9, 1930, and nine, Nos. 5694, 5833-35, 5837, 5839, 5842-43, and 5845, from Chitau, Jan. 12-16, 1931.

15. *Agama anchietæ anchietæ* Bocage

Agama anchietæ BOCAGE, 1896, Jorn. Sci. Lisboa, (2), 4, 129.

Seventy-two specimens of this species, collected as follows: 5697-5710, 5793-5831, 5836, Chitau, Jan. 12-16, 1931; 5726-29, 5923-26, Gauca, Jan. 8-10, 1931. The trinomial is necessitated by the description of two related forms, *methueni* and *knobeli*, by Boulenger and Power. The present Angolan specimens are in excellent agreement with their diagnosis of the typical form (Boulenger and Power, 1921, Trans. Roy. Soc. S. Africa, 9, 268).

16. *Agama atricollis* Smith

Agama atricollis SMITH, 1849, Illustr. Zool. S. Africa, 3, Appendix, 14.

Eight specimens, C. M. Nos. 5695-6, 5832, 5838, 5840-41, 5844, 5846, all collected at Chitau, Jan. 12-16, 1931.

17. *Chamæsaura miopropus* Boulenger

Chamæsaura miopropus BOULENGER, 1894, Proc. Zool. Soc. London, 1894, 732.

A single specimen, C. M. 5919, Chitau, Jan. 14, 1931, is referred to this species with some hesitation. *C. miopropus*, described from Fwambo, Nyasaland, might well prove to be one of the numerous savanna forms whose area of distribution borders the Congo Forest on the south, paralleling the east-west range of so many Sudanese species to the north of the forest. The present specimen agrees with *miopropus* in possessing monodactyle hind limbs and extremely minute vestiges of forelimbs; it differs in having 24 scales around the body in place of 26. As both *C. anguina* and *C. tenuior* have been shown to have from 24 to 26 scale rows around the body, the same range of variation may be expected in *miopropus*. The *C. macrolepis* from Angola recorded by Bocage may be referable to *C. miopropus*.

18. *Varanus albigularis angolensis*, subsp. nov. (Plate II.)

Type.—Carnegie Museum, No. 5967, ♂, collected at Gauca, Bihe, January 10, 1931, by Rudyerd and Laura Boulton.

Diagnosis.—A *Varanus* closely allied to *Varanus albigularis* of Cape Colony and the Bechuanaland Protectorate, in body form and scale characters, especially the small nuchals, but distinguished by having larger scales everywhere on the body so that the scales around the body are about 125 instead of 150, and the transverse rows of scales from the collar to thighs are 75 instead of 100.

Description of type.—Habitus stocky, tail round at base, flattened and with a slightly serrate keel for most of its length, tip round; abdominal scales smooth, seventy-four from collar to groin; no transversely enlarged supraoculars; nostril an oblique slit, three times more distant from the tip of the snout than from the eye; nuchal scales little enlarged, 18 in the first head-length; ear opening large; 127 scales around midbody; 53 scales around the tail at the 40th verticil; color dark gray with obscure darker and lighter patches, and with a few scattered groups of light gray or yellow scales; belly and under sides of limbs and tail yellow, invaded by the gray color from the sides; throat and chin black.

Measurements.—Length 1125 mm.; tail 650 mm.; snout to occiput 82 mm.; snout to posterior border of ear 90 mm.; width of head 55 mm.; arm 143 mm.; leg (about) 190 mm.

Paratype.—A single specimen in Field Museum, No. 12971, collected at Kabengere, Belgian Congo, by J. T. Zimmer, 1926, agrees remark-

ably with the Angolan specimen; it has 125 scales around mid-body, 75 scales from gular fold to groin, and 56 scales in the 40th caudal verticil.

Remarks.—Specimens of *V. albigularis* in the Museum of Comparative Zoology from Durban, Natal, and Somkele, Zululand, agree with specimens in Field Museum of Natural History, from the Bechuanaland Protectorate, in having 100 or more scales from gular fold to groin. In the one Zululand specimen and four from the Bechuanaland Protectorate the number of scales around the body ranges from 150 to 165, which is very distinct from the 125 to 127 of *angolensis*; in the specimen from Durban, however, the maximum count is about 137. In the Bechuanaland specimens the scales in the 40th caudal verticil range from 61 to 72, compared with 53 to 56 in *angolensis*.

The small nuchal scutes of this form relate it so clearly to *albigularis* rather than to *exanthematicus*, that I am inclined to give up the subspecific arrangement for the African savanna species of *Varanus* which I proposed in 1919 (Bull. Amer. Mus. Nat. Hist., 39, 480). *Varanus albigularis angolensis*, however, fits excellently into the general scheme of distribution of African reptiles, in which the remarkable east-west savanna fauna in the Sudan is paralleled by a related but specifically wholly distinct series in the savannas from Angola to the Katanga south of the rain-forest.

19. ***Ichnotropis bivittata* Bocage**

Ichnotropis bivittata BOCAGE, 1866, Jorn. Sci. Lisboa, 1, 43.

Sixteen specimens of this well marked species, C. M. Nos. 5725, 5927-28, Gauca, Jan. 8-10, 1931, and 5847-59, Chitau, Jan. 12, 1931.

20. ***Gerrhosaurus flavigularis nigrolineatus* Hallowell**

Gerrhosaurus nigrolineatus HALLOWELL, 1857, Proc. Acad. Nat. Sci. Philadelphia, 1857, 49.

Gerrhosaurus flavigularis nigrolineatus STERNFELD, 1912, Wiss. Ergeb. Deutsch Zentral Afrika Exped., 4, 224.

Three specimens, C. M. 5922, Gauca, Jan. 8, 1931, and 5791-2, Chitau, Jan. 12, 1931.

21. ***Mabuya bayonii* (Bocage)**

Euprepes bayonii BOCAGE, 1872, Jorn. Sci. Lisboa, 4, 75.

Sixteen specimens, C. M. 5736, 5738-39, 5935, 5937, 5939-40, 5943, from Gauca, Jan. 8-10, 1931, and 5866, 5869, 5880-81, 5890-91, 5893, and 5902 from Chitau, Jan. 12, 1931.

22. Mabuya striata (Peters)

Tropidolepisma striatum PETERS, 1844, Monatsber. Akad. Wiss. Berlin, 1844, 36.
Mabuia striata BOULENGER, 1887, Cat. Lizards Brit. Mus., 3, 204.

Thirty-seven specimens of this species are all from the high grass savanna: C. M. Nos. 5863-5, 5867-68, 5870-79, 5882, 5885-89, 5892, 5894-5901, 5903-4, Chitau, Jan. 12, 1931, and 5936, 5938, 5950, 5952, Gauca, Jan. 8, 1931.

23. Mabuya varia (Peters)

Euprepes (Euprepis) varius PETERS, 1867, Monatsber. Akad. Wiss. Berlin, 1867, 20.

Mabuia varia BOULENGER, 1887, Cat. Lizards Brit. Mus. 3, 202.

One hundred and fifteen specimens, all from the high grass savanna region, like the last species; C. M. Nos. 5671, 5731-5, 5737, 5740-64, 5883, Chitau, Jan. 12-16, 1931, and 5730, 5941-2, 5944-9, 5951, 5953-60, 5962-3, Gauca, Jan. 6-10, 1931.

24. Mabuya punctulata (Bocage)

Euprepes punctulatus BOCAGE, 1872, Jorn. Sci. Lisboa, 4, 76.

Mabuia punctulata BOULENGER, 1887, Cat. Lizards Brit. Mus. 3, 204.

A single specimen, C. M. 5648, from Mucungu.

25. Mabuya chimbana Boulenger

Mabuia chimbana BOULENGER, 1887, Cat. Lizards Brit. Mus. 3, 204.

A single specimen, C. M. 5655, from Humbe, Nov. 13, 1930.

26. Chamæleo dilepis Leach

Chamæleo dilepis LEACH, 1819, in Bowditch, Miss. Ashantee, 493.

Seventy-seven specimens, C. M. Nos. 5657-70, 5672-93, 5711, 5765-90, Chitau, Jan. 12-16, 1931; 5723, 5929-31, Gauca, Jan. 8-10, 1931.

SERPENTES**27. Helicops bicolor (Günther)**

Limnophis bicolor GÜNTHER, 1865, Ann. Mag. Nat. Hist., (3), 15, 96, pl. 2, fig. C.
Helicops bicolor BOULENGER, 1893, Cat. Snakes Brit. Mus., 1, 274.

Three specimens, C. M. Nos. 5912-13, 5990, from Chitau, Jan. 14-16, 1931. In these specimens, all females, the dorsal scales are uni-

formly 19-17, the upper labials 8-8, the lower labials 10-10, the oculars 1-2, and the temporals 0-1-2 on each side; the ventrals and subcaudals are respectively 131, 137, 135 and 48, 49, and 49.

28. **Boædon lineatus** Duméril and Bibron

Boædon lineatus DUMÉRIL and BIBRON, 1854, Erpet. Gen., 7, 363.

A single specimen, C. M. No. 5916, from Chitau, Jan. 14, 1931; a female, ventrals 198, caudals 64, upper labials 8-8, lower labials 9-9; oculars 2-2, and temporals 1-2 on each side; dorsal scales 25-27-19.

29. **Lycophidion capense capense** (Smith)

Lycodon capensis SMITH, 1831, S. African Journ. Sci., 1, No. 5, 18.

Four specimens, three from Chitau, C. M. Nos. 5713, 5917, and 5992, Jan. 14-16, 1931, and one from Gauca, C. M. No. 5921, Jan. 8, 1931. In two females from Chitau, the ventrals are 180 and subcaudals 28 in each. The male specimen from Gauca has 171 ventrals and 37 caudals. The head shields are uniform in all four, with eight upper and eight lower labials; oculars 1-2, and temporals 1-2 on each side.

30. **Philothamnus semivariegatus** Smith

Philothamnus semivariegatus SMITH, 1849, Illustr. S. African Zool., 3, pls. 59, 60, and 64.

A single specimen, C. M. No. 5994, from Chitau, Jan. 16, 1931. A male with dorsal scales 15-11, ventrals 191, subcaudals 125, upper labials 9-9, and lower labials 10-10; preoculars 1-1, postoculars 2-3; temporals 2-2 on each side. A small specimen of *Mabuya striata* was found in the stomach.

31. **Crotaphopeltis shrevei** Loveridge

Crotaphopeltis shrevei LOVERIDGE, 1932, Proc. Biol. Soc. Washington, 45, 83.

A single specimen of this recently described species agrees very closely with the unique type, which came from Bella Vista. The Carnegie Museum specimen, No. 5911, from Chitau, Jan. 14, 1931, a male, has 216 ventrals, anal single, 82 caudals, 8 upper and 10 lower labials, oculars 1-2, and temporals 1-1; the total length is 925 mm., tail 185 mm.

32. **Psammophis sibilans** (Linnæus)

Coluber sibilans LINNÆUS, 1758, Syst. Nat.

Psammophis sibilans BOIE, 1827, Isis, 1827, 547.

A single specimen, C. M. No. 5905, Chitau, Jan. 14, 1931, a female with dorsal scales 17-13, ventrals 166, caudals 92, upper labials 8-8, lower labials 9-10, oculars 1-2 on each side, and temporals 2-2 and 2-3; total length 1400 mm., tail 404 mm.

33. **Psammophis angolensis** (Bocage)

Amphiophis angolensis BOCAGE, 1872, Journ. Sci. Lisboa, 4, 82.

Psammophis angolensis BOULENGER, 1891, Proc. Zool. Soc. London, 1891, 307.

A single specimen, C. M. No. 5656, from Humbe, collected Nov. 13, 1930; a female, dorsal scales 11-11-11, ventrals 152, subcaudals 82, upper and lower labials 8-8; oculars 1-2 and temporals 2-2 on each side.

34. **Dispholidus typus** (Smith)

Bucephalus typus SMITH, 1829, Zool. Journ. 4, 441.

Dispholidus typus BOULENGER, 1896, Cat. Snakes Brit. Mus., 3, 187, fig. 14.

Eight specimens, C. M. Nos. 5906, 5907, 5909, and 5986-89, from Chitau, Jan. 14-16, 1931.

35. **Elapsoidea guentheri** Bocage

Elapsoidea guentheri BOCAGE, 1866, Journ. Sci. Lisboa, 1, 70, pl. 1, fig. 3.

A single specimen, C. M. No. 5914, ♀, Chitau, Jan. 14, 1931; dorsal scales 15-13, ventrals 150, subcaudals 20, upper and lower labials 7-7, oculars 1-2 and temporals 1-2 on each side; 28 transverse light lines on the body and 4 on the tail, which really correspond to the 14-2 dark cross-bars which are subequal to the slightly paler interspaces; total length 321 mm., tail 24 mm.

36. **Naja nigricollis** Reinhardt

Naja nigricollis REINHARDT, 1843, Vidensk. Selsk. Skrift., 10, 269, pl. 3, figs. 5-7.

A single specimen, C. M. No. 5908, Chitau, Jan. 14, 1931; ♂, dorsal scales 23-19-13, ventrals 206, caudals 63, upper labials 7-7, lower labials 8-8, oculars 1-3 on each side, temporals 1-3 and 2-2; length 1395 mm., tail 239 mm.

37. **Dendraspis angusticeps** (Smith)

Naja angusticeps SMITH, 1849, Illustr. Zool. S. Africa, 3, pl. 70.

Dendraspis angusticeps GÜNTHER, 1838, Cat. Snakes Brit. Mus., 238.

Two male specimens, C. M. Nos. 5977-78, from Mulondo, November 1930; dorsal scales 21-23-17 in both; ventrals 265 and 263, subcaudals 113 and 122, upper labials 8, lower labials 11-11 and 12-12; oculars 2-2, and temporals 2-3, in No. 5977, 3-4 and 2-4 in No. 5978; total length and length of tail respectively 2480 and 615 mm., and 2365 and 515 mm. A female specimen, No. 5910, from Chitau, Jan. 14, 1931, has dorsal labials 8, lower labials 12, oculars 2-4, and temporals 2-4.

38. **Causus rhombeatus** Lichtenstein

Sepedon rhombeatus LICHTENSTEIN, 1823, Verz. Doubl. Mus. Berlin, 106.

Causus rhombeatus GRAY, 1849, Cat. Snakes Brit. Mus., 33.

Five specimens, C. M. Nos. 5720, 5915, 5920, 5991, and 5993, from Chitau, Jan. 14-16, 1931.

39. **Atractaspis congica** Peters

Atractaspis congica PETERS, 1877, Monatsber. Akad. Wiss. Berlin, 1877, 616, fig. 2.

A single specimen, ♀, C. M. No. 5918, collected at Chitau, Jan. 14, 1931, has dorsal scales 17-19-15; ventrals 221; caudals 20, of which 5 are entire; upper labials 5-5, lower labials 6-6; oculars 1-1; temporals 1-2 on each side; and total length 292 mm., with tail 15 mm.

40. **Bitis arietans** (Merrem)

Vipera (Echidna) arietans MERREM, 1820, Tent. Syst. Amphib., 152.

Bitis arietans GÜNTHER, 1858, Cat. Snakes Brit. Mus., 268.

Sixteen specimens, C. M. Nos. 5712, 5714-19, 5721, 5722, 5979-85, from Chitau, Jan. 14-16, 1931.

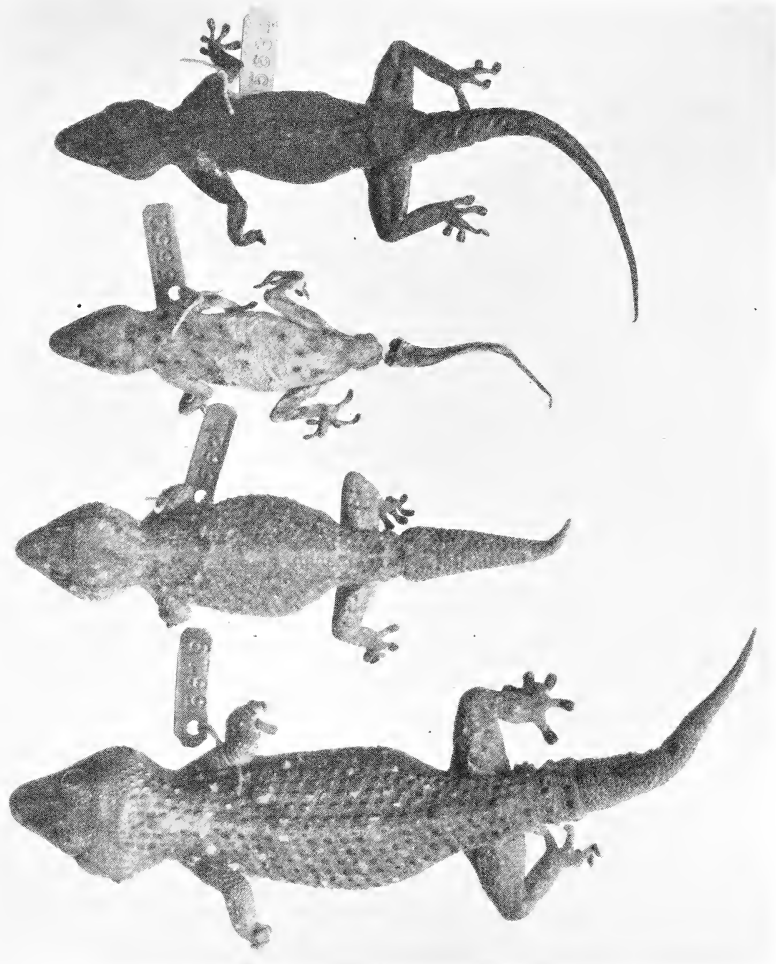


PLATE I. From left to right, *Pachydactylus bibronii pulitzeræ* (type), *Pachydactylus lavigatus*, *Rhoptropus barnardi*, and *Rhoptropus boulloni* (type).

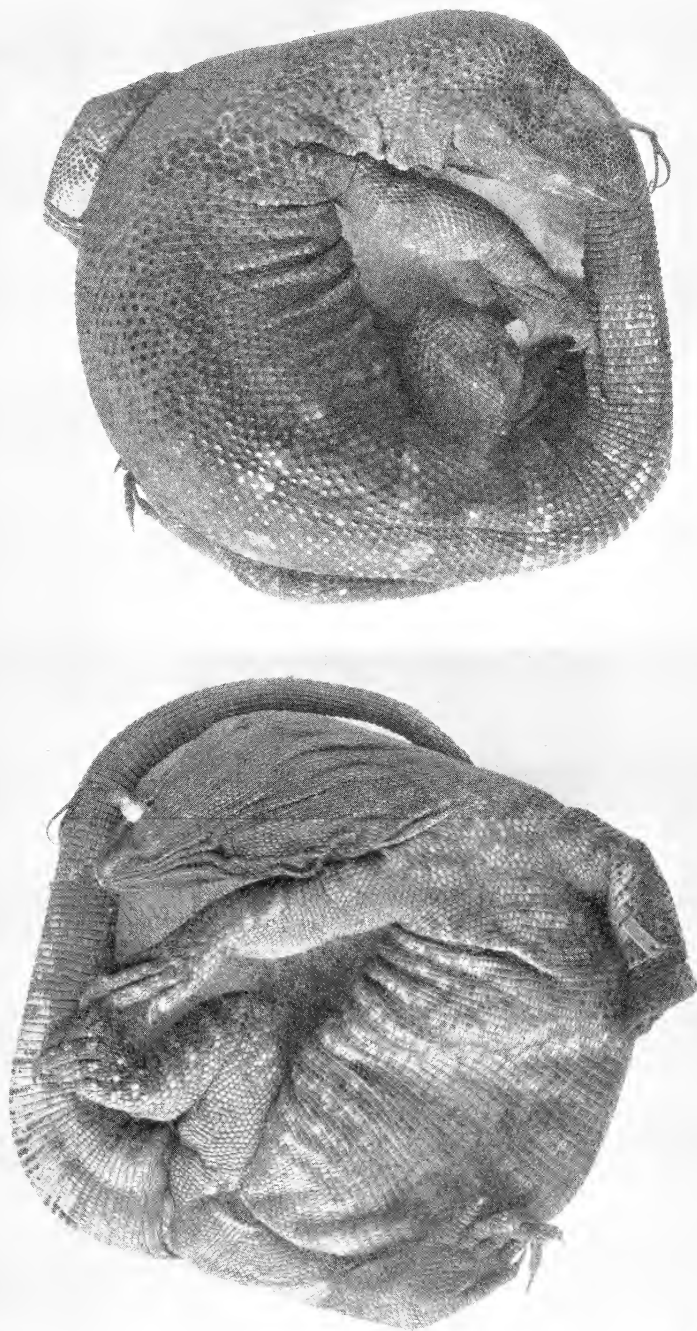


PLATE II. Type of *Varanus albigularis angolensis*.

II. FLORA OF THE KARTABO REGION BRITISH GUIANA¹

By EDWARD H. GRAHAM

(PLATES III-XVIII)

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¹The present paper, in condensed form, was submitted to the Graduate School of the University of Pittsburgh in partial fulfilment of the requirements for the degree of Doctor of Philosophy in June, 1932.

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INTRODUCTION

The writer visited Kartabo² in the summer of 1924, spending from June 28 to August 9 at the laboratory building (*See* Plates V and VI) which had been turned over, by Dr. William Beebe, to a group of University of Pittsburgh students, of whom the writer was one. Dr. Beebe and his party from the New York Zoological Society had occupied the building for several years, and their work at the Tropical Research Station of the New York Zoological Society in this locality is well known. The building had originally been constructed to house engineers who had cut a trail 95 kilometers (60 miles) through the jungle from Kartabo to the Puruni River where they had worked a mine for a short time. The students were enrolled in a field ecology course under the direction of Dr. A. E. Emerson, now of the University of Chicago. Dr. Emerson had previously spent two years at the station studying the insect life of the region, particularly the termites, with a knowledge of which his name is now intimately associated. Each member of the party also collected biological specimens representing some natural group, the writer being the only one who collected plants.

The writer wishes to express his most sincere appreciation to Dr. A. Avinoff, Director of the Carnegie Museum, Pittsburgh, Pa., and to Dr. O. E. Jennings, head of the Department of Botany at the University of Pittsburgh and Curator of Botany at the Carnegie Museum, for invaluable aid and inspiration throughout the preparation of this work. Through a student loan fund for tropical research, sponsored by Dr. H. D. Fish, former professor of Zoology at the University of Pittsburgh, the writer owes to Dr. Fish the opportunity of visiting Kartabo and the possibility of making a plant collection from the region. For encouragement and helpful criticism and for aid in the identification of many of the plants, appreciation is extended Dr. H. A. Gleason of the New York Botanical Garden, whose knowledge of British Guiana plants is well recognized. For the opportunity of comparing his specimens with those in the United States National Herbarium and for the identification of certain Pteridophyta, the writer wishes to thank Dr. Wm. R. Maxon. The following specialists have also generously aided in the identification of various groups of

²The name has been variously spelled, as Cartabu, Kartabu, Ororabo and so on, but modern maps use the spelling adopted here.

plants: Dr. Wm. Trelease of Urbana, Ill., Piperaceæ; Dr. Lyman B. Smith of the Gray Herbarium, Bromeliaceæ; Dr. Albert C. Smith of the New York Botanical Garden, certain Pteridophyta; Dr. N. L. Britton of the New York Botanical Garden, Cyperaceæ and Leguminosæ; Dr. Paul C. Standley of the Field Museum, Rubiaceæ; Dr. Ellsworth P. Killip of the United States National Herbarium, Passifloraceæ; Dr. Robert E. Woodson, Jr. of the Missouri Botanical Garden, Apocynaceæ; and Mr. Harold N. Moldenke, of Plainfield, N. J., Verbenaceæ. For painstaking aid in checking citations, typing, and reading proof, the writer owes a debt of gratitude to his wife, Mary Baird Graham. For the use of photographs reproduced here as Plates III, IV, V, IX, XII, XIV, XV, XVII and XVIII, the writer is indebted to Dr. Hugh M. Raup, who was a member of the University of Pittsburgh party to Kartabo in 1924; Plates VI, VII, VIII, X, XI, and XVI, have been furnished by Dr. Wm. Beebe and are used with his permission and the permission of the publishers; Plate XIII was kindly furnished by Mr. J. Kenneth Doult, also a member of the 1924 Kartabo party.

AREA COVERED AND COLLECTIONS TREATED IN THIS FLORA

The specimens upon which the present work is based are those from within a radius of 95 kilometers (60 miles) of Kartabo and now to be found in the Herbarium of the Carnegie Museum at Pittsburgh, Pennsylvania, where the present paper was prepared. They consist of the collections made by the writer and by J. S. De La Cruz, the latter under the direction of Dr. H. A. Gleason of the New York Botanical Garden and received by the Carnegie Museum through exchange. Ten localities are represented, five by Graham collections and five by collections of De La Cruz. The five localities of the Graham collections are: (a) Kartabo; (b) Kalacoon, Hills Plantation, 5 kilometers (3 miles) from Kartabo on the south side of the Mazaruni River; (c) Kyk-over-al, an island at the junction of the Mazaruni and Cuyuni Rivers; (d) along Camaria road, Cuyuni River, 13 kilometers (8 miles) west of Kartabo; and (e) at Matope, Cuyuni River, 32 kilometers (20 miles) northwest of Kartabo. The five localities represented by De La Cruz collections are: (a) Bartica, 8 kilometers (5 miles) east of Kartabo; (b) Wismar, on the Demerara River, 55 kilometers (35 miles) southeast of Kartabo; (c) Malali, on the Demerara River, 88 kilometers (55 miles) south southeast of Kartabo; (d) between the Deme-

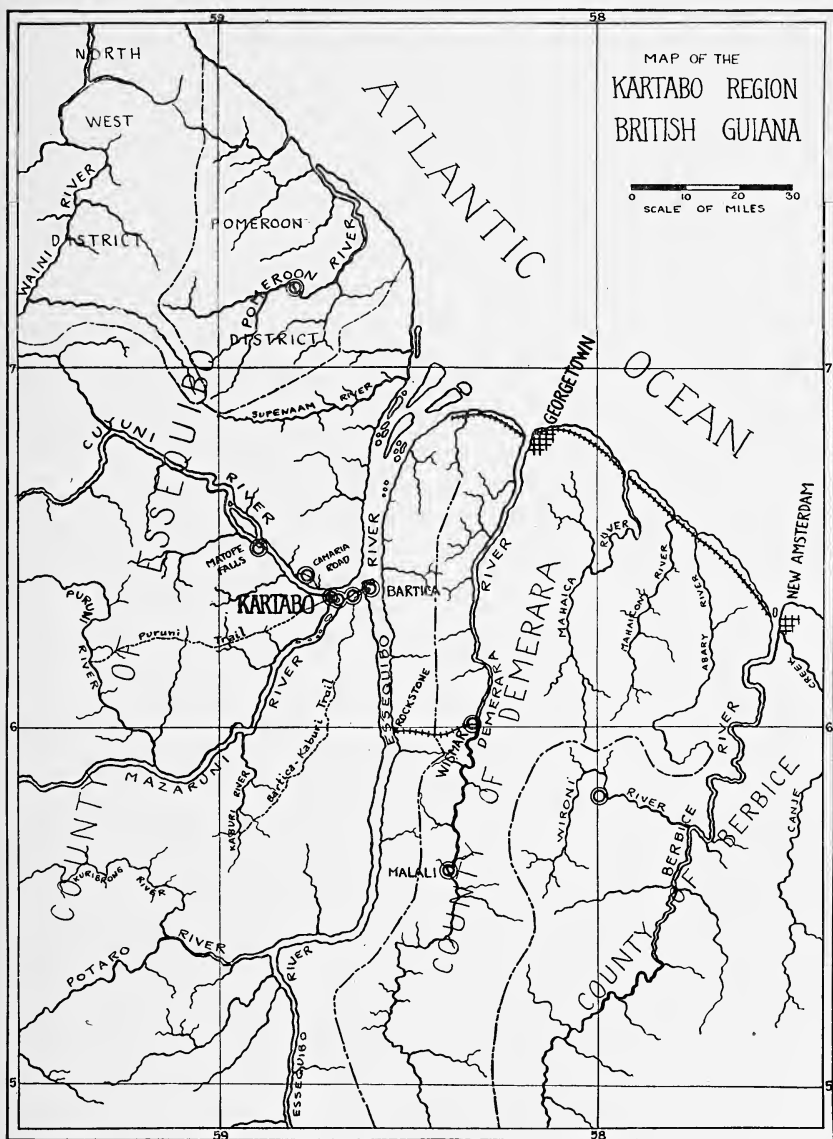


FIG. 1. The ten circles designate the ten chief localities which are represented by specimens in the present treatment. For explanation see text, p. 20.

rara and Berbice Rivers, 95 kilometers (60 miles) southeast of Kartabo; and (e) along the Pomeroon River, Pomeroon District, some 80 kilometers (50 miles) north of Kartabo. The region represented by these localities is covered with a tropical rain-forest vegetation. The coastal strip, although within the 95 kilometer (60 mile) radius, is not represented in the Museum's collection, and is largely under cultivation or populated with introductions and widely distributed tropical weeds. In the region between the Demerara and Berbice Rivers near Wismar, the vegetation is a white sand scrub described by Hitchcock (1920) as similar to that found in central Florida. While this area is within the 95 kilometer (60 mile) radius and there are a few plants from that region in the collection and listed in the present work, it is believed that they may also occur in sand areas of the rain-forest itself and are an integral part of the rain-forest complex. The present contribution is offered as a local flora involving the tropical rain-forest as it exists in northern South America, and the lack of such a local treatment for any locality in the region has furnished the chief incentive to the completion of the present work. In addition to those species represented by specimens in the herbarium, an effort has been made to list species mentioned in the general literature on the flora of the colony. These plants, however, are not treated as fully as those represented by specimens, and are not embraced in the keys. The rain-forest here referred to is that type of vegetation defined by Schimper (1903) as a forest "evergreen, hygrophilous in character, at least 30 meters high, but usually much taller, rich in thick-stemmed lianas, and in woody as well as herbaceous epiphytes."

COLLECTING METHODS

Because of the high humidity of the tropics, plant collecting requires a little more care than in temperate climates.³ It was necessary to employ artificial heat, which was generated by burning an ordinary kerosene lantern in the bottom of a large dry-goods box. The driers were placed edgewise across the open top of this box, the heat from the lantern passing up through them. If the driers were not sufficient in number to cover the open top of the box, boards were placed on the open space to force the heat through the driers. The lantern burned day and night, and it was only necessary to apply new driers to the

³See also Hitchcock, A. S., Report on a recent trip to British Guiana. *Journal of the New York Botanical Garden* 21: 136. 1920.

most succulent specimens, since two or three days time was sufficient to dry most plants. After the plants were thoroughly dried they were wrapped in large sheets of wax paper, such as florists use, to prevent absorption of moisture and molding. Inside each bundle of plants so wrapped naphtha flakes were placed. Each plant was numbered and notes kept in an accompanying notebook. The driers used were single-faced corrugated cardboards and blotters. After use these were generally dried out on the laboratory porch in the sunlight or over the lantern, because if laid in the open they required constant attention, as we were never sure how soon a tropical shower would occur. A large vasculum was necessary as a few woody, tropical plants with large and leathery leaves will soon fill even a large collecting can. Some fungi and mosses (not included in this treatment and reported upon separately, see p. 50 for references) were dried by sunlight when placed in a sheltered position where an unexpected rain would not reach them, as on the porch of the laboratory. As soon as dry, each of these was wrapped in wax paper. Little attention was given the hard fruits, except that legumes and others likely to split open or curl were pressed under considerable pressure, forcing them to dry without bending. Some of the smaller fleshy fruits dried by artificial heat, the larger ones were only properly preserved in a 4 per cent solution of formaldehyde. When the fruits were not on the sheets with the leaves and flowers care was taken to number them correspondingly. Miscellaneous notes were taken and are here incorporated into the systematic treatment.

THE COLONY OF BRITISH GUIANA

GEOGRAPHICAL POSITION

British Guiana, the westernmost of the three Guianas, French, Dutch, and British, is a British colony on the northeastern coast of the continent of South America. On the north it is bounded by the Atlantic Ocean, on the west and southwest by Venezuela and Brazil respectively, on the south by Brazil, and on the east by Dutch Guiana or Surinam, as it is still sometimes called. The country lies between the parallels 1° and 8° North and the meridians 57° and 61° West. The colony has a coast line of some 435 kilometers (270 miles) extending southeastward almost from the Orinoco River to the Courantyne River which forms the eastern boundary of the colony. British

Guiana is roughly trapezoid in shape, its long axis running north and south, with its eastern edge 483 kilometers (300 miles) in length and its western 870 kilometers (540 miles). The area of the colony is 231,640 square kilometers (89,480 square miles), which is about twice the area of the state of Pennsylvania. The English language is spoken throughout the colony. The name Guiana, according to the *Encyclopædia Britannica* (1910, 1929), is probably derived from the name of Indian tribes occupying the territory when it was discovered, a group well known in Brazil, the Guayana tribes, called by earlier writers Guianas, Goyana, Guayana, etc.

THE ABORIGINES

The original inhabitants of British Guiana were Indians, who have been divided into four tribes according to British Empire Exhibition (1924). They are (a) the Warraus or swamp Indians who inhabit the coast lands and are described as a timid people; (b) the Arawaks who inhabit the slightly elevated lands lying between the lower reaches of the rivers and who seem to be the most progressive of all; (c) the Caribs, including the true Caribs, cannibalistic and great fighters, who previously lived along the coast and made frequent sallies into the West Indies but who are now confined to the upper Barima, Barama, and Cuyuni Rivers, the Akawois, born traders and good humored, who inhabit the upper Mazaruni, and the Macusis, a small tribe of the savannah country of the south; and (d) the Wapisianas, also of the savannahs, described as taciturn but with much decision of character. The *Encyclopædia Britannica* (1910) states that the Guiana Indians, who are small of stature and decidedly mongoloid in appearance, have been derived from tribes of Brazil, driven northward by other more hostile Indian tribes before the appearance of the white man in South America.

HISTORY

The coast of British Guiana was first seen by white man when Columbus discovered the island of Trinidad in 1498. As early as 1580 the Dutch had established trade with the Spanish main but their first voyage to Guiana was in 1598. By 1613 there were three or four Dutch settlements along the coast and about 1616 some Zeelanders

settled at Kyk-over-al, an island strategically situated at the junction of the Mazaruni and Cuyuni Rivers near Kartabo, some 72 kilometers (45 miles) in a direct line from the coast. In 1781 British privateers captured the region, only to lose it to the French, who were than allies of the Dutch, to whom it was soon restored. In 1796 Britain again gained possession but in 1802 the peace of Amiens restored the territory to Holland. The following year it was recaptured by the British and it is then, 1803, that the history of British Guiana proper is said to begin. The colony was finally transferred to Great Britain at the Great Peace of 1814-15. In 1831 the three colonies, now represented by the three counties Essequibo, Demerara, and Berbice, were consolidated into one. Each county includes, roughly, the drainage system of the river after which it is named. It is interesting to note that the British once founded a colony on the Surinam River, which, in 1667, they exchanged with the Dutch for what is now New York City. The colony on the Surinam is now Dutch Guiana.

POPULATION

In 1925 the population of British Guiana was about 300,000 persons, giving an average of 3.5 persons per square mile. Of this number only 16,000 were whites, of whom 11,500 were Portuguese. The greatest number were East Indians, of whom there were 124,000; the blacks and Africans ranked next with 120,000. Of the aboriginal Indians there were about 6,500. The remaining 33,500 were mixed, unclassified, with a small proportion of Chinese. The majority of the population is to be found along the coast. The capital of the colony, Georgetown, which is situated along the coast at the mouth of the Demerara River, has a population of about 60,000, and is the only city of any consequence in the colony. New Amsterdam, at the mouth of the Berbice River, some 60 miles southeast of the capital, has a population of about 8,000. There are various villages along the coast and for some distance up the principal rivers, which hold the rural population. A very small proportion of the total population is to be found in the interior, large tracts of which are often charted as unexplored. There are many places which are seldom, if ever, visited, even by the aborigines, because of the difficulty of travel in the forest, and the great expanses of savannah land which lie to the south.

PHYSICAL GEOLOGY OF BRITISH GUIANA

PHYSICAL DIVISIONS

Nearly the whole of the colony is a worn-down plateau of ancient crystalline schist and gneiss overlaid in places, especially in the southern part, by beds of Mesozoic sandstone, into which have been intruded dikes and sheets of diabase and other igneous rocks. Brown and Sawkins (1875) published a fairly comprehensive report on the physical, descriptive, and economic geology of British Guiana. The colony may be divided physiographically into three divisions: (1) the alluvial coastal plain; (2) the undulating sand and clay belt; and (3) the interior plateaus and mountains.

I. THE ALLUVIAL COASTAL PLAIN

The most northern of the three divisions is a fluvio-marine deposit extending inland and gradually rising to a height of 3 to 4.5 meters (10 to 15 feet) above sea level. This alluvial plain varies in width from about 16 kilometers (10 miles) in the western part of the colony to nearly 80 kilometers (50 miles) along the Courantyne River on the eastern border. It is traversed by ridges of sand and shells which indicate former shore lines. Along the coast this region is below the level of high tide and the sea is excluded by a long sea wall, with a system of sluices and dikes controlling the inter-tidal drainage. Almost the whole of the cultivated area of the colony lies in this coastal strip. The drinking water of the coast region is obtained from rain water caught in tanks. The general water supply of Georgetown and the neighboring plantations is obtained from the East Coast Water Conservancy which is a swampy area lying southeast of the city where dikes have been built to impound the water in an area of several square kilometers. The water is led to its destination by a series of canals. In other parts of the colony water, other than rain water, is safest for drinking only after it has been boiled 15 to 20 minutes.

2. THE UNDULATING SAND AND CLAY BELT

South of the coastal plain there is a broad belt of land forming a low plateau which varies in elevation from 5 to 60 meters (15 to 200 feet). This region is one interspersed with sand dunes and clay hills with practically sedentary soils. In width this zone, which runs the breadth of the colony, varies greatly, reaching closer to the coast

in the western part of the colony. Along the rivers the land may be low and swampy. This division is principally covered with dense, high, rain-forest. Kartabo and the region included in the present flora are within the limits of this physiographic division.

3. INTERIOR PLATEAUS AND MOUNTAINS

Farther south of this intermediate division is the higher mountainous zone, a series of plateaus 365 meters to nearly 600 meters (1200 to nearly 2000 feet) in elevation. Like the intermediate belt this southern zone is much broader in the western part of the colony than in the eastern. These hinter-lands are undulating open savannahs rising into hills and mountains, some grass-covered, others in dense forests. In the west-central part of the colony, where Venezuela, Brazil, and British Guiana join, the mountains reach their greatest extent. There a series of conglomerates, red and white sandstone, and red shale rests upon the gneiss which underlies it to form the remarkable table-topped mountains of Roraima and Kukenaam. Roraima is the higher, its precipitous sides reaching up 1525 meters (5000 feet) above the surrounding country to an elevation of 2620 meters (8600 feet). The beds which form these mountains are of uncertain age, but are probably Paleozoic or Cretaceous. The mountains rise in terraces and broad plateaus and in the northern part of this higher area where the plateaus border the zone of sand and clay there is a sandstone escarpment over which the rivers plunge in many picturesque falls, the most famous of which is Kaieteur, on the Potaro River, 160 kilometers (100 miles) south southwest of Kartabo. This magnificent falls has a vertical, uninterrupted drop of 225 meters (741 feet) and a width at the brink of 120 meters (400 feet). In the most southern part of the colony the elevation of the savannah land is 90 to 120 meters (300 to 400 feet).

RIVER SYSTEMS

One of the most conspicuous features of the physiography is the network of rivers which covers the colony. All flow northward into the Atlantic Ocean. The greatest of these is the Essequibo, one of the largest rivers in the world, with a width of 22.5 kilometers (14 miles) at its mouth. Its source is in the Akari Mountains in the south-

ernmost part of the colony, from which it flows north for a distance of more than 950 kilometers (600 miles). The Essequibo, together with its great tributaries, the Potaro, the Rupununi, and the Mazaruni and Cuyuni Rivers, the latter two joining at Kartabo 10 kilometers (6 miles) above Bartica where they together enter the Essequibo, drains considerably more than half the area of the colony. Second in size among the colony's rivers is the Courantyne, whose left bank forms the eastern boundary of the colony. The Berbice River, west of and parallel to the Courantyne, is navigable for large craft farther than any other of the rivers, the steamer terminus being 175 kilometers (110 miles) from the coast. The Demerara, between the Essequibo on the west and the Berbice on the east, is commercially the best known of all the rivers, although comparatively small. On the eastern bank at its mouth, Georgetown has been established, where the river has a width of about a kilometer and sufficient depth to furnish a safe harbor. The Pomeroon River drains the area north and west of the mouth of the Essequibo, and has along its banks some of the most fertile farms of the colony. The Waini River, in the northwestern part of the colony, is navigable for 85 kilometers (53 miles) where the Barama empties into it. Still farther to the northwest lies the Barima River, which gives access to the gold-bearing district of the northwest. All of these larger rivers are fed by a vast number of tributary streams so that the colony is well drained by a great network of waterways which at present provides the only means of access to the interior. At a distance of from 80 to 115 kilometers (50 to 70 miles) from the coast most of the rivers are interrupted by rapids, and further access to the interior is gained only with some difficulty.

MINERALS

Several ores and minerals have been found in British Guiana, the most important of these being gold, diamonds, and bauxite. Gold has been found in all the rivers except the Courantyne and Berbice, the greatest supply being obtained from the northwestern half of the colony. Diamonds are also important, the proved diamondiferous area being between the Potaro and the Cuyuni Rivers. Bauxite, aluminum ferric hydroxide, the principal ore of aluminum, is found in readily accessible situations on the Demerara River, where it is being mined.

BOTANICAL EXPLORATION IN BRITISH GUIANA

The flora of British Guiana has not received the attention from trained botanists which its wealth of plants warrants, neither from a systematic nor an ecological standpoint. One finds fewer references in the classical literature to the flora of the region now known as British Guiana than are to be found for those regions now known as Dutch Guiana, or Surinam, and French Guiana respectively, especially the former. One of the most frequently quoted of all the early systematic works on the botany of the Guianas is that of J. B. C. F. Aublet, who collected plants in French Guiana from 1762 to 1764 and in 1775 published a 4-volume work on the "*Histoire des Plantes de la Guiane Française*." Phillipe Fermin, in his "*Histoire Naturelle de la Hollande Equinoxiale*" of 1765 devotes nearly 100 pages to the plants of Dutch Guiana. M. S. Merian's "*Histoire Generale*," published in 1771, deals with "*des Plantes des Surinam*" in volume 1. Others such as Rottboell, Noyer, Miquel, and Sagot have written about the plants of the region. Two early workers on the flora of British Guiana were E. Rudge who in 1805 published his "*Plantarum Guianae Rariorum Icones et Descriptiones*" and G. F. W. Meyer who in 1818 published his "*Primitiæ Floræ Essequiboensis*." The present location of their collections is not certainly known, though probably that of the former is at Kew and that of the latter at Oxford.

In British Guiana the first plant collections of importance were made by Robert Schomburgk during the years 1835-1839 and by his brother, Richard Schomburgk, who journeyed into the interior with Robert in the years 1840-1844. They collected in the Kartabo region as well as at other widely scattered points throughout the colony. The specimens of the Schomburgks were worked up by Bentham (1840). The largest set of their specimens is now at the Royal Botanic Gardens, Kew, and duplicate sets are widely distributed in European herbaria. Nearly every specimen is a type. A list of plants without descriptions is given in volume 3 of Richard Schomburgk's "*Reisen in Britisch Guiana*," published in 1848, which deals with the fauna and flora of the region. R. Appun collected in British Guiana and adjacent regions from 1849 to 1868; his specimens are at Kew. G. S. Jenman, who became superintendent of the Georgetown Botanic Gardens in 1879, made many collections which now form the basis of the Herbarium at the gardens, now officially known as the Jenman Herbarium and many

of his specimens are at Kew. The Georgetown collection is well arranged and accessible for study, and contains collections subsequently made by ImThurn on Roraima, by McConnell and Quelch at the same place, and by Bartlett, Stockdale, Abraham and other recent botanists connected with the local garden. E. Ule, after collecting in Brazil, travelled up the Amazon River and Rio Branco to Mount Roraima where he collected many new species, although from his labels one cannot now determine whether his specimens came from British Guiana, Venezuela, or Brazil. His collections are now at Berlin and Kew. In the latter part of 1919 and the early part of 1920, Dr. A. S. Hitchcock, of the United States Department of Agriculture, collected in the colony and in 1922 published the "Grasses of British Guiana." In the fall of 1921 Dr. H. A. Gleason of the New York Botanical Garden visited British Guiana and made collections at several localities. Since that time the Botanical Garden at New York has enlisted the services of J. S. De La Cruz as a botanical collector. De La Cruz collected throughout the colony during the years 1922 to 1927 and working on this material Dr. Gleason has published a great deal concerning the plants of the colony, particularly in the description of many new species, in various numbers of the Bulletin of the Torrey Botanical Club for the years 1922 following. In the summer of 1924 the writer collected in the vicinity of Kartabo about 500 numbers of plants, with two duplicates of each number. These are now in the Herbarium of the Carnegie Museum at Pittsburgh, Pennsylvania with incomplete duplicate sets at the New York Botanical Garden at New York City and the National Herbarium at Washington, D. C. Since the writer visited the region an expedition was made in 1929 under the auspices of the Oxford University Exploration Club. Mr. N. Y. Sandwith from the Kew Gardens, England, was a member of the expedition, which worked particularly on Moraballi Creek, a tributary of the Essequibo, at a point about 30 kilometers (18 miles) southeast of Kartabo. Recent numbers of the Kew Bulletin (1930 fol.) include valuable contributions to the flora of the region based on these collections and Hingston (1932) has published a general account of the expedition.

PLANTS OF GEORGETOWN

For one who visits the tropics for the first time even the plants which are found in the cities hold an intense interest, and those of

Georgetown are no exceptions. Since many of the native plants of the colony will not thrive near the sea, Georgetown has a scant representation of them, most of the plants grown in the city being introduced things of rather cosmopolitan tropical distribution. However, among the indigenous plants about the city may be found the great Silk-Cotton Tree, *Bombax pentandrum*, from the large fruit capsules of which is obtained the kapok of commerce; the Sand-Box Tree, *Hura crepitans*, also a large tree; the Hog Plum, *Spondias lutea*; and the Long-John, *Triplaris surinamensis*. The Cannon-Ball Tree, *Couroupita guianensis*, may be found along Georgetown streets. It has flowers and fruits in a tangle of short branches along the trunk between the lowest branches and the ground. Its spherical, brown fruits are about 15 cm. in diameter and foul-smelling, although the flowers are fragrant. The Wakenaam Lilac, *Jacaranda ovalifolia*, is conspicuous because of the long racemes of lavender flowers. In moist situations the Wild Cocoas, *Bombax aquaticum*, known locally as the Konaheri, and *B. insigne*, the Konaheri-balli, are striking trees with great blossoms nearly a foot in diameter with numerous long, slender stamens. Among the palms which are native to the colony and present in the capital are the Akuyuro, *Astrocaryum tucuma*; the Awarra, *A. tucumoides*; and the Pimpler Palms, *Bactris major* and *B. flavispina*. In the Botanic Gardens, which are quite extensive, one finds the native Manicole Palm, *Euterpe edulis*, frequent in swampy regions, which has 6 to 12 stems, very feathery and graceful, with leaflets of a pale-green color. Here also will be seen the Rehu, *Euterpe stenophylla*, a slender-stemmed palm resembling the preceding. The Ité or Aeta, *Mauritia flexuosa*, is one of the most abundant of Guiana palms with a stout column surmounted by a great crown of large, dark-green, split-fan leaves. It is found in the gardens with the Kokerit Palm, *Maximiliana regia*. The latter is one of the grandest native palms, the large feathery leaves of which rise almost straight from the ground when young, but later, when the stem has developed to a great height, resemble huge, curled ostrich plumes as they sway in the wind. One of the climbing palms, *Desmoncus macroacanthus*, with prolonged midribs covered with long, reflexed thorns, is also to be found. Along the avenues of the Botanic Gardens are specimens of the Locust, *Hymenaea Courbaril*, an immense tree, and another tall tree of the colony, which often has buttressed roots, the Mora, *Mora excelsa*. Other trees to be seen here are the Balata, *Mimusops globosa*, which

furnishes a native rubber; the Cedar, *Cedrela odorata*; Crabwood, *Carapa guianensis*; Wallaba, *Eperua falcata*; Mangrove, *Rhizophora Mangle*; Trysil, *Pentaclethra macroleoba* and species of *Ficus*. *Petreaa volubilis* is a coarse, woody vine with pale-blue, flowing spikes of flowers. It is found in almost every garden of the city together with the yellow-flowered Allamanda, *Allamanda cathartica*. In the lakes, and often in the canals, one can see Bladderworts, *Utricularia* spp.; Water Hyacinths, *Eichhornia diversifolia*; Water Lettuce, *Pistia stratiotes*, which is an aquatic arum often grown as an aquarium plant; and the water ferns, *Salvinia auriculata* and *Azolla caroliniana*. Floating on the waters of the lakes in the Botanic Gardens is the Royal Lily, *Victoria regia* (See Plate III), native to the colony on the waters of its eastern rivers, with immense saucer-shaped leaves and large, handsome flowers which, upon blooming, last only for a day and a half, and are nocturnal. Along the edges of the streams is the Mucka-Mucka, *Montrichardia arborescens*, a characteristic arum of the river shores with leathery leaves, arrowhead-shaped, and stems higher than one's head. In the Botanic Gardens one may find indigenous orchids, belonging to many genera.

Many of the conspicuous plants of the city are not natives of the colony, although the native species of palms are far more conspicuous elements of the flora in the towns than in the forest. Among the introduced palms is the traditional Coconut, *Cocos nucifera*, a common feature of the landscape here as it is in most tropical countries. The Cabbage Palm, *Oreodoxa oleracea*, is a common avenue tree with pinnate leaves resembling the coconut but with the inflorescence borne some distance below the crown of leaves, instead of in the axils of the leaves of the crown, as in the coconut. Less common than the Cabbage Palm is the Royal Palm, *Oreodoxa regia*, distinguished by its smooth trunk which bulges in the middle. In the Botanic Garden there is a Double Coconut, *Lodoicea sechellarum* Labillardière, native of the Seychelles, Indian Ocean. It is a tall, dioecious palm sometimes reaching 30 m. (100 feet) in height. Its leaves are palmate but not deeply cut into flabellate lobes or segments, the blade 2 m. across, the segments bifid, and the petiole 2-3 m. long. The flowers are in axillary spadices which are subtended by several truncate spathes. The fruit, 1-seeded and generally 2-lobed, is one of the wonders of the vegetable world, weighing often nearly 50 pounds. Of the many varieties of shade trees planted in the city the most common are the

Saman or Rain Tree, *Pithecellobium Saman*, a great tree with spreading, symmetrical, rounded top; the Flame Tree or Flamboyant, *Poinciana regia*, which in flower has its branches literally covered with scarlet flowers at a time when the leaves have dropped; and the Frangipani, *Plumeria alba*, with white flowers and large, stubby twigs. The Queen of Flowers, *Lagerstroemia speciosa*, which is a tall tree, and the Crape Myrtle, *Lagerstroemia indica*, which is a tall shrub, are frequent in gardens. In Georgetown the former is known as the King of Flowers and the latter as the Queen of Flowers. In the Botanic Gardens are excellent specimens of the Traveler's Tree, *Ravenala madagascariensis* (See Plate IV), a member of the banana family. Among the most striking flowers to be seen in the city are those of the Chinese Hibiscus, *Hibiscus rosa-sinensis*, which is extensively grown as a hedge plant. Other shrubs are the Rose-of-Sharon, *Hibiscus syriacus*, and the Coral Hibiscus, *H. schizopetalus*. The Crotons, *Codiaeum*, are present in great variety, cultivated because of the attractiveness of the mottled leaves and spirally twisted stems. The Copper Leaf, *Acalypha Wilkesiana*, with bronze-green or mottled heart-shaped leaves, is a common cultivated plant as is *Nothopanax Guilfoylei*, with white-margined leaves, which is grown as a hedge plant. Species of *Caladium* are frequently seen in yards, the sagittate leaves being considered beens or talismans of one sort or another, especially by the Indians. Among the ornamental vines is the *Bougainvillea*, native of Brazil, a gorgeous plant when in full flower. There are several species, of which the most common are known locally as *B. glabra* var. *Sanderiana*, which has purple bracts (commonly mistaken for the flowers), *B. spectabilis* var. *lateritia*, with terra-cotta bracts, and *B. glabra*, with pink bracts. Another vine is the Red Coralita, *Antigonon leptopus*. A strange-looking climbing lily is the Gloriosa, *Gloriosa superba*, with spirally twisted perianth parts. One often sees the common Christmas Plant, *Euphorbia pulcherrima*, planted as an ornamental. It becomes a good-sized shrub here and occasionally the Maize, *Zea Mays*, is observed as an ornamental grass in a yard. There are several grasses, although Hitchcock (1921) states that there is a marked absence or rarity of certain species which are common throughout the West Indies. *Andropogon bicornis* is a tall savannah grass which may be 2 meters high or more and is conspicuous in open areas.

Of the agricultural products of the colony the most important, and that for which the colony is noted, is sugar. Demerara rum is another

famous product and recent advances have been made in the development of the rice industry. Coconuts are grown, as are coffee and cocoa and various fibers, particularly Sisal and Crowa fibers, the latter from the wild pineapple. Oranges, limes, grapefruits and other citrus fruits are cultivated. Mangoes do well and pineapples, bananas, plantains, and some corn are grown. Cassava, yams, sweet potatoes, tannias, and eddoes as well as okra are cultivated in garden plots. One also sees breadfruit trees, avocados, papayas, custard apples, soursops and other universally distributed tropical fruits along the coast and in many interior villages.

ENVIRONMENTAL CONDITIONS AT KARTABO⁴

GEOGRAPHICAL POSITION

Kartabo is situated at the junction of two great rivers, the Cuyuni, which flows from the west, and the Mazaruni, which flows from the south. Each of these flows from far in the west, where the Cuyuni has its source in the wilderness of Venezuela and the Mazaruni its beginnings in the Roraima country of the southwest. From Kartabo the combined streams flow 10 kilometers (6 miles) to the Essequibo River, largest stream of the colony, where, at Bartica, they join that river as its largest tributary. Kartabo is thus situated in the north-central part of British Guiana, at latitude 6° 23' N., and longitude 58° 42' W. It is approximately 640 kilometers (400 miles) north of the equator and 72 kilometers (45 miles) in a direct line from the Atlantic Ocean, which lies to the northeast.

GEOLOGY

The rocks exposed at low tide are a clastic sedimentary rock caught up in, and intensely metamorphosed by, the granite which forms the underlying structure at Kartabo and the largest outcrop of the colony. Here beach along the Cuyuni consists of white quartz sand overlying firm deposits of creamy-white kaolin derived from the underlying granite, which decomposes very rapidly. The elevation of the immediate Kartabo area is 9 to 15 meters (30 to 50 feet) above sea

⁴Data concerning environmental conditions at Kartabo are taken largely from Beebe, Wm., *Studies of a Tropical Jungle; One Quarter of a Square Mile of Jungle at Kartabo, British Guiana. Zoologica* 6¹: 1-193. 1925.

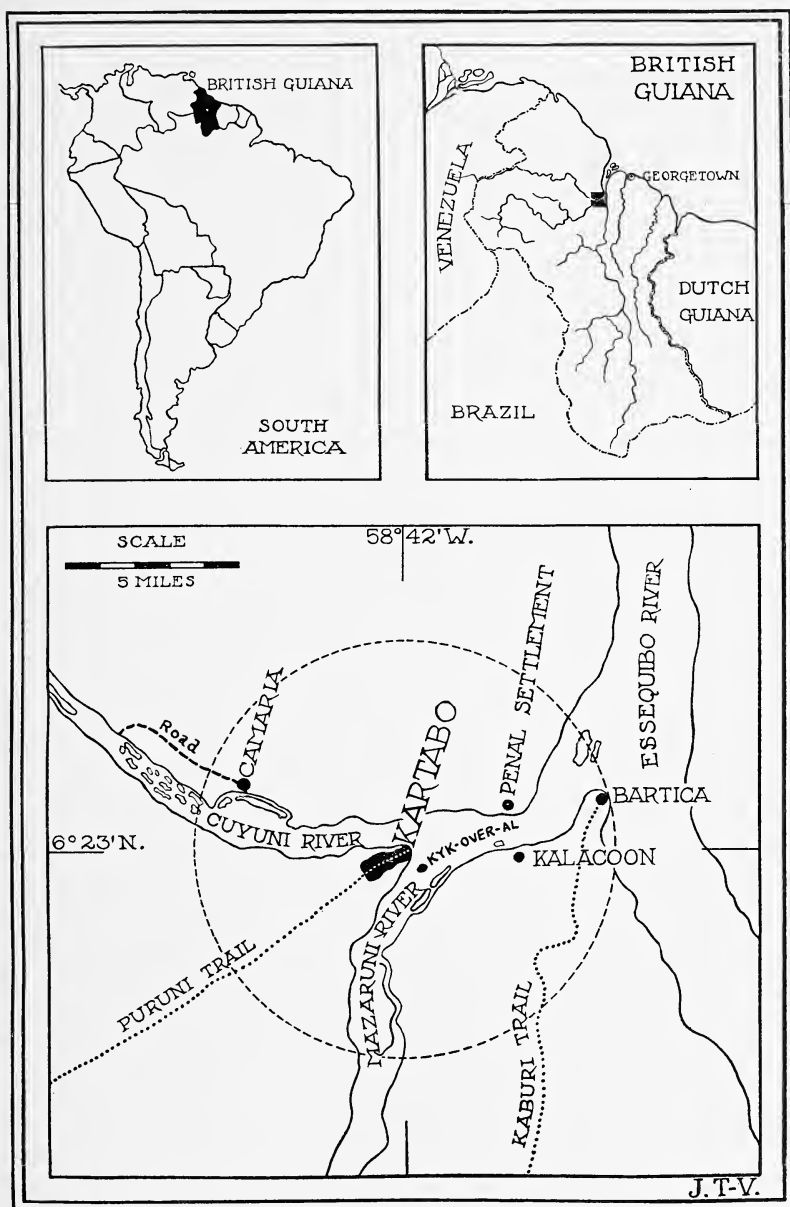


FIG. 2. Location of Kartabo, British Guiana. The circle represents a radius of six miles. Figure furnished by Wm. Beebe; slightly modified.

level, although within the area considered in this flora the elevation may reach 60 meters (200 feet).

TIDES

At Kartabo there is an average rise and fall of the tides of 2 meters (6.5 feet). High water at full moon gives tides of 2.5 meters (6 to 8 feet) higher than usual. Eight kilometers (5 miles) above Kartabo the tides on both rivers end, and there the first rapids are found. The time occupied by the rising and falling of the tide is dependent upon the amount of water coming down the rivers. The waters of the rivers at Kartabo are generally considered fresh, the tidal effect largely being due to backwash. However, the growth of Mangrove, *Rhizophora Mangle*, in the water along the shore would indicate that the water may, at least at some seasons, be somewhat brackish. The color of the water is a pale brown, reported derived from the leaves of the Wallaba, *Eperua falcata*. At Kartabo the temperature of the water below the surface and near the bottom averaged a little less than 26.5° C. (80° F.).

METEOROLOGY⁵

Accurate weather records have been taken for many years at His Majesty's Penal Settlement, 5 kilometers (3 miles) northeast by east from Kartabo, on the north shore of the Mazaruni River, and rain-fall records have been taken at the Hills Plantation, Kalacoon, on the south shore of the Mazaruni directly opposite the Penal Settlement. The results of some of these records are summarized below.

I. SEASONS

Four seasons are evident, as determined from the amount of rain-fall, which is given in the following lists in inches and per cent.

Short dry season	17.05 in.	16.8 per cent	February, March, April.
Long wet season	38.84 in.	38.4 per cent	May, June, and July.
Long dry season	25.27 in.	25.2 per cent	August, September, October, and November.
Short wet season	19.81 in.	19.6 per cent	December and January.

⁵Records begin with February, first month of the short dry season. Inches and degrees Fahrenheit are used in the meteorological tables, since they are borrowed directly from Beebe (1925).

The long dry season, from August to November, is generally to be depended upon, but the other seasons vary somewhat and are usually not distinct.

2. RAINFALL

MONTHLY AVERAGE IN INCHES

February.....	4.55
March.....	4.94
April.....	7.56
May.....	14.00
June.....	12.44
July.....	12.40
August.....	7.40
September.....	5.56
October.....	5.19
November.....	7.11
December.....	10.93
January.....	8.87

May averages the highest monthly rainfall; February or March the lowest. The average annual rainfall is 100.53 inches, and in no month is the average less than 4.55 inches. The highest rainfall for a single month was in May, 1918, with 22.34 inches and the lowest for a single month was in February, 1912, a year of drought, with .03 inch. The highest recorded annual rainfall is 117.75 inches, in 1918, and the lowest 77.11 inches, in 1911. The number of days upon which rain falls shows an annual average of 219, or 59 per cent, of the year.

3. HUMIDITY

MONTHLY AVERAGE IN PER CENT

February.....	82.9
March.....	81.5
April.....	81.1
May.....	85.3
June.....	85.0
July.....	85.2
August.....	85.1
September.....	82.1
October.....	81.2
November.....	82.9
December.....	87.0
January.....	84.8

The yearly average humidity is therefore 84.2 per cent. The available records for humidity show observations taken 3 times a day, at 7:00 a.m., 1:00 p.m., and 6:00 p.m. The mean of these observations is:

7:00 a.m. 90.9 per cent
1:00 p.m. 79.0 per cent
6:00 p.m. 82.2 per cent

4. SUNSHINE

MONTHLY AVERAGE IN HOURS PER DAY

February..... 5.5
March..... 4.3
April..... 5.1
May..... 4.0
June..... 5.2
July..... 4.2
August..... 6.2
September..... 6.8
October..... 6.7
November..... 6.3
December..... 5.5
January..... 4.6

The monthly average is 5.3 hours per day. The maximum amount for a single day was 11.6 hours, July 30, 1920.

5. TEMPERATURE

The minimum, mean, and maximum shade temperatures are given in the following lists, in degrees Fahrenheit:

	MINIUM	MEAN	MAXIMUM
February.....	73.3	78.0	82.8
March.....	73.1	78.1	83.2
April.....	74.2	79.0	83.8
May.....	75.1	79.2	83.2
June.....	74.1	78.4	82.8
July.....	74.0	78.4	83.3
August.....	75.2	80.0	85.0
September.....	75.5	81.1	86.5
October.....	75.6	81.5	85.2
November.....	74.8	80.3	85.9
December.....	73.8	78.6	83.5
January.....	73.2	77.8	82.5
Yearly average.....	74.3	79.2	83.9

When the writer was at Kartabo during the month of July, 1924, he found the average temperatures for that month, taken in the shade of the laboratory porch, to be:

7 a.m.	75° F.
12 noon	84° F.
9 p.m.	78° F.

The temperature in the sunlight, of course, is considerably higher than that in the shade, but no authentic dark bulb thermometer records are available.

6. WIND

Kartabo is situated on an open expanse of water, facing due east, from which the trade winds blow prevailingly. These breezes from the sea, 72 kilometers (45 miles) away, blow almost steadily during the day throughout most of the year, while during January, February, and March, they pleasantly continue through much of the night as well. Northeast winds are also common and during the rainy seasons the winds blow for a short time from the continental side, southeast or even south, and bring with them the heaviest falls of rain. Moderately severe thunderstorms occur occasionally, especially during the changes in the rainy seasons. The wind is remarkably even throughout the year, varying from Gentle to Fresh with very few Gales and no Hurricanes. The monthly average of the force of the wind, taken three times daily, ranges from May, the lowest month, with 4 kilometers (2.5 miles) per hour, to October, the highest, with 6.1 kilometers (3.8 miles) per hour. The average rate is 5.23 kilometers (3.25 miles) per hour.

7. EARTHQUAKES

Earthquakes are felt occasionally, sometimes with appreciable effects. During seven years, 1915 to 1922, six rather severe shocks have been recorded, and one night the writer, camped at Matope, 32 kilometers (20 miles) up the Cuyuni from Kartabo, was awakened by a very distinct vibration of the cot upon which he was sleeping, the cause of which could be attributable only to an earthquake.

8. METEOROLOGY OF KARTABO COMPARED WITH THE COAST-LANDS AND THE FAR INTERIOR

At Georgetown meteorological records have been accurately taken since 1846, and they show "the climate at Georgetown to be a very equable one, and one which . . . varies regularly and equably." In the far interior in the savannah lands of the plateau regions of Dadanawa, about 400 kilometers (250 miles) southeast by south from Kartabo, at about 2° 50' N. Latitude and about 59° 30' W. Longitude, and also at Eupékari, about 315 kilometers (195 miles) in the same direction from Kartabo at 3° 40' N. Latitude and 59° 18' W. Longitude records have also been taken. At Dadanawa the records tend to show a far less regular rainfall than at Kartabo; it also averages less in amount than at the coast and still less than in the forested region in which Kartabo is located. The temperature of the interior stations has also a greater range, the minimum being lower and the maximum higher than at the coast stations. The annual average of rainfall, humidity, and temperature of the stations at the coast, near Kartabo, and in the interior are as follows:

	COAST LANDS	KARTABO	INTERIOR
Rainfall.....	94.37 inches	100.53 inches	51.88 inches
Humidity.....	78.10 per cent	84.20 per cent	86.5 per cent
Temperature.....	80.4° F.	79.2° F.	83.1° F.

VEGETATION OF THE KARTABO REGION

While no special ecological study was made, it may be advisable to note here some of the more obvious plant associations of the jungle.

Within the area treated the tropical rain-forest may be considered a climax formation. Within this formation there are two prominent associations: (a) the fluvio-littoral association to be found along the edges of the rivers and (b) the forest association which forms the bulk of the vegetation. The forest association may be divided into six societies as follows: (a) high-forest society or first story; (b) mid-forest society or second story, composed of trees not so tall as the highest components; (c) low-forest society of shrubs, which may be called the third story; (d) forest-floor society or fourth story, which is the vegetation of herbs and ground plants; (e) epiphyte society, which is most prominent on the trees of the mid-forest society; and (f) the forest-margin society which forms a zone of vines wherever the

forest is broken, as along the rivers or at clearing edges. In addition to the two associations mentioned above, which are permanent parts of the formation, there is a secondary association or associates which might be termed the forest-clearing associates, which is a temporary vegetation developing toward the fluvio-littoral association or the forest association or both, depending upon environmental conditions.

FLUVIO-LITTORAL ASSOCIATION

The plants of this association (*See* Plate VII.) are to be found in the water near the shore of the river or slightly out of the water and above the submergence of high tide. Although not occurring in great abundance as far inland as Kartabo, one of the most conspicuous plants of this association is the Mangrove, *Rhizophora Mangle*, with its prop roots so striking at low tide. Another of the characteristic plants of the shore is the tall arum, *Montrichardia arborescens*, known in the region as Mucka-Mucka. Near the sea coast, where the effect of salt water is more pronounced, the White Mangrove, *Laguncularia racemosa*; the Courida, *Avicennia nitida*; and the Bindoree, *Drepanocarpus lunatus*, are also found as mangrove association plants.

Near the shore are to be found *Xyris Jupicæ* and *X. macrocephala* together with the rush-like sedge *Eleocharis geniculata*, which reaches a height of a meter or more. Other sedges are likely to be found along the shore among which are *Cyperus diffusus* and *Hypolytrum sylvaticum*. Beebe (1925) reports *Equisetum* sp. to have occurred along the shore at Kartabo in 1919 and to have disappeared by 1921. However, records of this genus from the colony have never been verified by collections according to Posthumous (1928). *Utricularia* is to be found in the water here, and three species are listed in the present work. Conspicuous monocotyledons along the shore are the Ginger Lily, *Hedychium coronarium*, and the Spider "Lilies," *Crinum comelyni* and *Pancratium guianense* which are both members of the Amaryllidaceæ, the latter species distinguished from the former by the possession of a staminal cup uniting the stamens at their bases. The gentian, *Coutoubea spicata*, grows near or in the water, with slender, erect spikes of sessile flowers.

The mangrove association plants listed above might be considered as forming a separate community, while those in the preceding paragraph, here listed as more truly fluvio-littoral, might better be treated as an aquatic expression of the forest-clearing associates, for they are

generally found where clearings have been formed along the shore, and where forest vegetation originally reached to the water's edge.

FOREST ASSOCIATION

1. HIGH-FOREST SOCIETY (*See* PLATES VIII AND XVII)

The tallest trees of the jungle reach a height of 30-45 m. (100 to 150 feet) with occasional giants stretching above the surrounding level of the tree tops. The forest trees, particularly the taller ones of the high-forest and mid-forest societies, are the least known, botanically, and among the most interesting plants of the jungle. It is nearly impossible to collect the flowers and fruits, and indeed the leaves, of many of the tallest trees. One of the commonest of the big trees of the forest is the Mora, *Mora excelsa* (*See* Plate VII), which is characterized by flanging, buttressed roots. Another of the tall trees is the Greenheart, *Nectandra Rodiaei*, one of the most valuable timber trees of the colony. Others are the Crabwood, *Carapa guianensis*; Eta-balli, *Vochysia tetraphylla*; Guana, *Cassia multijuga*; Wild Plum, *Spondias lutea*; Duka, *Tapirira guianensis*; the tall Locust, *Hymenæa Courbaril*; and the Suradanni, *Hyeronima laxiflora*, which, as one of the giants, often towers above the surrounding jungle. Another of the timber trees of the colony is the Purpleheart, *Copaifera pubiflora*. The Wild Nutmeg, *Myristica surinamensis*, and the Trysil, *Pentaclethra maculoba*, are also among the taller trees of the jungle. One of the tallest of the trees, often protruding above the general level, is the Simarupa, *Simaruba amara*. Other noteworthy species of the high-forest are the leguminous trees, *Peltogyne paniculata*, the Saka, *P. pubescens*, *Eperua Jenmani*, the Ituri Wallaba, and the lauraceous *Nectandra Pichurim*, known as Keriti Silverballi. Many of the timber trees of the forest are found here as well as in the mid-forest society, and for a list of these see the mid-forest Society, which follows.

2. MID-FOREST SOCIETY (*See* PLATE X)

Under the tallest trees there occurs a second story which varies in height between 7.5 m. and 25 m. (25 and 75 feet). Among these might be mentioned the Wild Guava, *Psidium guajava*; the Genip Tree, *Genipa americana*; and the Letterwood, *Brosimum Aubletii*. Various species of the mimosaceous genus *Inga* are found in the mid-forest, and the anonaceous genus *Rollinia* is represented here also. The

trees of this story are not so abundant as those of the higher and lower stories, and a great deal remains to be learned about the ones which do occur here.

The timber trees of the colony belong to this and the preceding societies of the forest formation. While it is a characteristic of the jungle that the plant species are well mixed, nevertheless, in some localities, almost pure stands of Crabwood, Greenheart, Wallaba, or Mora are known to occur, at least to the extent of composing 80 per cent of the stand. These purer stands are usually characteristic of the lower, more poorly drained lands, while the more elevated situations have a greater variety of species. In the forests of British Guiana, as in other tropical American countries, there stands a great wealth of timber. The principal timber trees⁶ of the colony are listed below under their common names:

Aramatta	<i>Diploptropis brachypetalum</i>	Papilionaceæ
Arisauro	<i>Vatairea guianensis</i>	Papilionaceæ
Balata, Bullet-tree, or Koberu	<i>Mimusops globosa</i>	Sapotaceæ
Balata-balli, Barata- balli, or Barta-balli	<i>Lucuma mammosa</i>	Sapotaceæ
Cedar or Kurana	<i>Cedrela odorata</i>	Meliaceæ
Crabwood or British Guiana Mahogany	<i>Carapa guianensis</i>	Meliaceæ
Dalli or Wild Nutmeg	<i>Myristica surinamensis</i>	Myristicaceæ
Determa	<i>Nectandra</i> sp.	Lauraceæ
Duka	<i>Tapirira guianensis</i>	Anacardiaceæ
Dukalli-balli or Dukala- balli	?	
Euriballi, Yuraballi or Huraballi	?	
Fotui, Futui, or Phootee	<i>Jacaranda Copaia</i>	Bignoniaceæ
Greenheart or Bibiru	<i>Nectandra Rodiaei</i>	Lauraceæ
Hackia or Ironwood	<i>Tabebuia</i> or <i>Tecoma</i> sp. or <i>Siderodendron</i> sp.	Bignoniaceæ Rubiaceæ
Haiawa-balli or Zebra- wood	<i>Connarus guianensis</i>	Connaraceæ
Hubu-balli or Hou-boo- balli	<i>Mimosa guianensis</i>	Mimosaceæ
Ite-balli, Eta-balli, or Aeta-balli	<i>Vochysia tetraphylla</i>	Vochysiaceæ

⁶The list is taken from Zon and Sparhawk, Forest Resources of the World. British Guiana 2: 735. 1923. 2 vol. The work contains a bibliography of forestry works dealing with the colony.

Itiki-boura-balli or Tigerwood	<i>Machærium Schomburgkii</i>	Papilionaceæ
Kabukalli	<i>Goupia glabra</i>	Celastraceæ
Kakeralli	<i>Lecythis</i> sp.	Lecythidaceæ
Keriti, Kretti, or Keriti Silverballi	<i>Nectandra Pichurim</i>	Lauraceæ
Kurahara	?	
Letterwood, Snakewood, or Burokoro	<i>Brosimum Aubletii</i>	Moraceæ
Locust, Simiri, or Cour- baril	<i>Hymenaea Courbaril</i>	Cæsalpiniaceæ
Mora	<i>Mora excelsa</i>	Cæsalpiniaceæ
Purpleheart or Koru- burelli	<i>Copaifera pubiflora</i>	Cæsalpiniaceæ
Purpleheart or Saka	<i>Peltogyne paniculata</i>	Cæsalpiniaceæ
Silverballi or Ciruaballi	Any of several of the	Lauraceæ
Silverballi, Brown	<i>Nectandra</i> sp.	Lauraceæ
Silverballi, Yellow	<i>Nectandra Pisi</i>	Lauraceæ
Simarupa	<i>Simaruba amara</i>	Simarubaceæ
Suradanni or Seridani	<i>Hyeronima laxiflora</i>	Euphorbiaceæ
Tatabo or Sciopera	<i>Bowdichia</i> sp.	Papilionaceæ
Tauroniro, Tawonero, or Umiri	<i>Humiria floribunda</i>	Humiriaceæ
Tonka Bean or Kumara	<i>Dipteryx odorata</i>	Papilionaceæ
Trysil, Koroballi, or Kuruballi	<i>Pentaclethra filamentosa</i>	Mimosaceæ
Ulu, Olu, or Ooloo	<i>Trattinickia rhoifolia</i>	Burseraceæ
Vogelkop, Fogelkop, or Kudibutshi	<i>Sideroxylon</i> sp.	Sapotaceæ
Wadaduri or Monkey- Pot	<i>Lecythis grandiflora</i>	Lecythidaceæ
Wallaba	<i>Eperua</i> sp.	Cæsalpiniaceæ
Wallaba, Soft	<i>Eperua falcata</i>	Cæsalpiniaceæ
Wallaba, Ituri	<i>Eperua Jenmani</i>	Cæsalpiniaceæ
Wamara, Clubwood, or Brazilian Ebony	<i>Swartzia tomentosa</i>	Cæsalpiniaceæ
Warakuri or White Cedar	<i>Tabebuia longipes</i>	Bignoniaceæ

3. LOW-FOREST SOCIETY (See PLATE X)

This society is composed largely of spindly shrubs about 6 m. (20 feet) high, forming a third story in the jungle make-up. Here are the palms (See Plate XI), an inconspicuous element in the great mass of vegetation which surrounds them. Two of those which inhabit swampy parts of the forest are the Manicole, *Euterpe edulis*, and the Ité Palm, *Mauritia flexuosa*. Here also occur the Awarra Palm, *Astrocaryum*

tucumoides, and the Akuyuro Palm, *Astrocaryum tucuma*, of which a single specimen stands before the laboratory building at Kartabo. What is often accredited the grandest of British Guiana palms is the Kokerit, *Maximiliana regia*, which is to be found in this society. Among this lowest of the tree stories are found a great many rubiaceous shrubs of the genera *Cephalis*, with gaudy flower bracts; *Psychotria*; *Palicourea* and others. Here also are shrubs of the pepper family, belonging to the genera *Piper* and *Pothomorphe*, with odd, erect spikes of flowers. One soon learns to recognize here many of the Melastomaceæ, a family distinctively characterized by prominent longitudinal leaf-veins, generally 3 to 5 or sometimes more in number. To this family belong species of the genera *Clidemia*; *Henriettea*; *Miconia*, especially well represented; *Tococa*; and others.

4. FOREST-FLOOR SOCIETY (See PLATE XII)

The plants on the floor of the forest might be said to constitute a fourth story. It is generally not rich in the higher plants, and not particularly rich in other forms, but numerous species are to be found here nevertheless. Among the most striking of the floor plants are the taller monocotyledonous constituents such as the Heliconias, represented by *Heliconia acuminata*, which has glossy, stiff leaves and reed-like stems higher than one's head. The marantas of the genera *Calathea*, *Maranta*, *Monotagma* and *Ischnosiphon* have long-petioled banana-like leaves that are conspicuous elements on the forest floor. Day-flowers of the genera *Commelina* and *Dichorisandra*, with peculiar jointed stems formed of the leaf-sheaths, occur here also. The Melastomaceæ is represented on the floor as well as in the low-forest society, but by different genera, one of the most frequent herbs of this family being *Nepsera aquatica*, with distinctive, delicate, loose panicles of small flowers. Other genera of the family are *Aciotis* and *Desmoscelis*. Ferns of the tree family, Cyatheaceæ, such as *Hemitelia* and *Alsophila blechnoides*, sometimes reach a height of 3 m. while on the ground one can find carpets of *Selaginella*, of which there are many species. The flaccid, pilose herb *Episcia mimuloides* belongs here as a conspicuous member of the low-forest society.

5. EPIPHYTE SOCIETY (See PLATE XIII)

It is in the high forest and particularly upon the trees of the mid-forest society or the layer which they characterize that most of the

epiphytes occur. They are chiefly arums, bromeliads, orchids, and ferns. The arums are generally the most striking, because they are the largest, one which the writer observed being large enough to fill a good-sized room if transplanted from its position high in the crotch of a jungle tree. It looked very much like *Monstera pertusa*, with large cream-colored spathes nearly a foot long, and long-petioled leaves much exceeding the spathe. One of the common epiphytic bromeliads is *Aechmea humilis*, in the axils of whose leaves the unwary collector may find hosts of stinging ants. Many other genera of this family are also found as frequent epiphytes, such as *Guzmania* and *Tillandsia*. The Spanish Moss of southeastern United States, *Tillandsia usneoides*, was not observed in the forest, and no specimens are listed in the flora, although it might occur along the coast. While the orchids are more frequent at higher elevations, some are to be found near Kartabo, such as members of the genera *Epidendrum*, *Dichæa*, *Oncidium*, and *Aganisia*. Many ferns are included among the epiphytes of the region. *Hymenophyllum polyanthos* is often epiphytic upon epiphytes, its fronds membranous and delicate. Many of the Polypodiums, such as *Polypodium ciliatum* and *P. percussum*, the latter unfern-like in appearance with linear fronds, are frequently observed. Species of *Clusia*, the Strangling Fig, are epiphytic plants of the Guttiferæ which often eventually kill the plant upon which their seeds come to rest and start to grow, as their developing roots entwine the trunk and limbs of the host and the rapid extension of their spreading branches overshadows it. The profusion of epiphytic plants as they occur in the rain-forest of this region is one of the characteristics of the South American jungle, and one not easily forgotten, even by one who is not botanically inclined.

6. FOREST-MARGIN SOCIETY (See PLATES XIV AND XV)

Wherever the forest is interrupted, as at the edge of a river, or the edge of a clearing, or along a trail, a great tangle of vines collects to form a curtain which generally shuts from view whatever may exist behind it. It is quite probable that some of the larger vines are also so congregated on the tops of the trees, where sunlight is available. Conspicuous among these vines is the Allamanda, *Allamanda cathartica*, a common plant of tropical regions, whose large, yellow flowers are visible at a great distance. The Marcgraviæ, *Marcgravia cuyuniensis*, *M. purpurea*, and *Souroubea guianensis*, are among the con-

spicuous climbers of this society. The flowers of *Marcgravia* have peculiar sac-like nectaries hanging below them, which form striking inflorescences. Two members of the madder family, *Posoqueria longiflora* and *P. latifolia*, are strong vines with clusters of gracefully pendent, white flowers which stand out in strong contrast to the deep-green foliage behind them. The former species has flowers with corolla tubes 35-40 cm. long. *Combretum Aubletii* and *C. brunnescens*, the Caterpillar Flowers, are coarse vines also found at the forest periphery. Trumpet Creepers such as *Cydista æquinotialis* and *Arrabidaea candicans* are also to be found here with *Dioclea glabra*, which has velvety, purple flowers. In the midst of these vines, especially along the rivers, one often sees, like a blaze of pinkish light, the immense and magnificent flowers of the Wild Cacao, *Bombax aquaticum*, or the broad, divided fronds of the Tree Fern, *Alsophila microdonta*.

FOREST-CLEARING ASSOCIES

Wherever, in the forest, a clearing is made, generally the result of man's activities, a different type of vegetation is to be found. (See Plates XVI, XVII and XVIII). In two or three years' time a cleared space will be so overgrown with a mass of vegetation that it becomes nearly impossible to force one's way through. This second growth is much more impenetrable than any part of the primeval jungle. One of the first trees to appear in a newly cleared area is the Trumpet Tree, *Cecropia angulata*, the leaves of which are reputed to form the sole food of the sloth, and which is a tree long recognized as an example of myrmecophytism. Young trees of the Cashew, *Anacardium occidentale*, are also common, as well as myrtaceous shrubs of the genera *Psidium* and *Calycolpus*. Species of the genus *Vismia* and the Torchwood, *Protium heptaphyllum*, also occur here as shrubs. Trailing over the mass of shrubby plants there is a long, slender, much-branched Club Moss, *Lycopodium cernuum*, and a semi-climbing sedge, *Scleria secans*, locally known as Razor Grass, which has recurved spines on the edges of the leaves which are capable of inflicting deep scratches in one's flesh. On the ground, especially in sandy soil, is the prostrate madder, *Sipanea pratensis*, dubbed Mazaruni Primrose by some of the inhabitants. *Diodia sarmentosa* occurs in a somewhat similar habitat. Many of the plants which are found here are of wide tropical distribution and may be considered weeds, such as the mallows, *Sida acuta* and *S. rhombifolia*; the Red Milkweed, *Asclepias*

curassavica; Finger Grass, *Syntherisma sanguinalis*; the sedge, *Scleria melaleuca*; the Velvet Weed, *Waltheria americana*; Black Nightshade, *Solanum nigrum*; *Scoparia dulcis*; *Borreria ocimoides*; and a cucurbit, *Momordica charantia*. With these occurs a climbing composite, *Mikania micrantha*, and other members of the same genus, and another of the same family, *Emilia sonchifolia*. Especially common along the trails are *Wulffia baccata* and *Wedelia trilobata*, both yellow-flowered herbaceous composites, while in the open clearings many woody vines appear, as the malpighiaceae genera *Banisteria*, *Hiræa*, and *Mascagnia*. One of the most conspicuous vines is *Petræa Schomburgkiana*, with long racemes of bluish flowers and calyx lobes with a distinct venation resembling that of the leaves. Plants which sometimes assume shrubby proportions in the clearings are various species of *Solanum*; *Lantana camara*; and *Stachytarpheta cajanensis*.

GENERAL REMARKS ON THE VEGETATION

In the rain-forest there is generally a distinct lack of anything like a pure stand of trees, the forest species seemingly scattered at random, although the Crabwood, *Carapa guianensis*, Greenheart, *Nectandra Rodiæi*, Wallaba, *Eperua* sp., and the Mora, *Mora excelsa*, are often found in approximately pure stands. The topmost branches of the tallest trees intermingle to form an almost solid mat of vegetation, above which stretch only occasional giants. Little light but that which is diffused penetrates this mat of leaves, and the sparser growth below has generally been attributed to the lack of light. Recent experiments by Toumey⁷ tend to show that the light is not the only factor determining this scantier growth beneath the tree tops but that lack of moisture, due to extreme competition among the roots of the forest plants, also plays an important part in the limitation of sub-stories of the vegetation. One can but imagine the great tangle of roots which must exist beneath a forest so luxuriant as that in the vicinity of Kartabo. Many vines reach the tops of the tall trees where light is available, and their thick stems, often flattened and twisted, and hanging loosely from the upper branches of the trees, are a characteristic feature of American rain-forests. (See Plates VIII and XVII). They are generally spoken of as lianes or lianas and are also locally called bush-ropes. Another feature so distinctive of the jungle is the

⁷Toumey, J. W. In a paper read before the Cleveland meeting of the American Association for the Advancement of Science, December 29-January 3, 1930-31.

abundance of epiphytes. These occur in greatest profusion upon the limbs of trees of the second story, from which there hang perpendicularly the thin, cord-like roots of those epiphytes which Schimper (1903) terms hemi-epiphytes, which make contact with the soil for their supply of water. Many of the air-plants, the true proto-epiphytes and others, find it unnecessary to do this, obtaining their supply of water and nutrients in other ways. On the leaves and twigs of the trees, particularly those nearer the ground, there is an astonishing abundance of fungi, lichens, leafy liverworts, and mosses. Some of these are phosphorescent and present strange appearances after dark. While there are not a great many mosses on the forest floor, numerous species occur on fallen logs and tree trunks, one of the commonest of which is *Rhaphidorrhynchium subsimplex* (Hedwig) Brotherus. The bark of the trees, which is generally smooth with little development of corky tissue, is covered with colored lichens of many hues. Many of the trees which are not strictly evergreen, such as the Mora, have their young leaves brilliantly colored, particularly red, so that in new leaf they may easily be mistaken for trees in flower. On the floor of the forest there is not an impenetrable mass of vegetation, but there often is in clearing second growth. In the forest one is able to see for some distance, the chief hindrance to travel being the fallen vines or the bases of those which extend to the trees above. Thorns are uncommon, except on some of the palms, like the trunks of *Bactris* or the climbing stems and leaves of *Desmoncus*. On the floor there is a layer of leaf mulch which is generally moist, dry only in excessive periods of drought, and varying in depth from a few centimeters to several decimeters. There is a striking absence of fallen trees in the jungle, undoubtedly due to the rapid distintegration of the wood by termites and other insects, bacteria, and smaller fungi. The abundance of these organisms of decay also prevents the leaf mulch from accumulating to a greater depth. Although there are a great many of the smaller parasitic fungi one sees very few of the larger forms, a mushroom or shelf-fungus being a rarity. Perhaps this, too, is because the rapid decay of the woody parts of dead and fallen trees leaves little substratum for their development. Flowers are not at all conspicuous elements of the forest, and although they may be fairly common, yet in proportion to the total mass of the vegetation they seem to form a relatively small part of the total plant growth. Fallen blossoms may be observed on the forest floor and one often hears the buzzing of

insects or smells a fragrance which tells him that flowers must be present, though usually far out of reach. Along the trails and rivers there are the most flowers, of both vines and trees, for here growing parts are most active and present their most luxurious aspect. As compared with a temperate region, the Kartabo flora is especially rich in woody forms, for well over 50 per cent of the species are trees and shrubs. Woody vines constitute nearly 25 per cent more, leaving the herbaceous forms to constitute considerably less than one-fourth of the total vegetation. The jungle as a whole at first impresses one as a great mass of vegetation with very little order or system, if compared with some of our northern forests, but more intimate acquaintance shows this to be false, and ecological work on the plant communities of the jungle will surely prove of intense interest and great value.

SYSTEMATIC TREATMENT^{8,9}

NOTES ON THE SYSTEMATIC TREATMENT

The systematic treatment of the Kartabo plants which follows includes Pteridophyta and Spermatophyta, the latter group being represented only by Monocotyledoneæ and Dicotyledoneæ, the Gymnospermæ being absent from the region.

The sequence of the families adopted is that of Engler and Prantl's *Die Natürlichen Pflanzenfamilien* of 1897. The arrangement of the genera and species is an arbitrary one and has been determined by the order in which they key out. The nomenclature is in accordance with the International Rules. Free use has been made of the existing floras of various regions in the American tropics and the writer has freely used the several excellent works which are available. The synonymy is not complete in every instance but a careful attempt has been made to include the more important and most frequently used names. The species descriptions are synoptic and intended chiefly as an aid in checking identifications made in the field by running

⁸Eighty-six field numbers of fungi were collected in the vicinity of Kartabo, all representing the higher fungi. Dr. D. R. Sumstine of Pittsburgh was kind enough to study these specimens and to identify them. A list of identifications was made but, unfortunately, before the list was received or the specimens returned, both were lost in a fire.

⁹For a list of the bryophytes collected, see Graham, Edward H., *Bryophytes of the Kartabo Region, British Guiana*, *Bryologist* 36: 59-67. 1933.

through the keys. The keys are all artificial and do not attempt to show relationships. They have been constructed, as far as possible, on the more easily recognizable field characters, and their efficiency can only be properly tested by further field work. The keys to families and many of those to genera are adaptations from already existing keys and the writer is deeply indebted to various floristic and monographic studies. The key to the families of monocotyledons is adapted chiefly from Pittier (1917) and that to the families of dicotyledons chiefly from Hutchinson (1926). Complete keys are given to families, genera, and species represented by specimens; species listed without specimens are not included in the keys.

The present work on the ferns and flowering plants of the Kartabo region includes 119 families and 624 species. It is interesting to note the families which are richest in species within the tropical-rain forest area treated. The Rubiaceæ is represented by the largest number of species, 34; in the Melastomaceæ there are 31 species; in the Papilionaceæ 33; Cæsalpiniaceæ 21; and Mimosaceæ 15. If the last three families are combined as the Leguminosæ, they would lead the list with 69 species, but they are not here so treated. Other families which are represented by more than 10 species are: Polypodiaceæ 21 species; Orchidaceæ 21; Palmæ 19, although many listed are not native; Cyperaceæ 16, Euphorbiaceæ 17; Malpighiaceæ 16; Compositæ 15; Malvaceæ 13; Guttiferæ 12; Apocynaceæ 12; and Convolvulaceæ 12.

If one were to compare the flora of the Kartabo region with that of an equivalent area around Pittsburgh, he would find many of the families which are well represented in the temperate area very poorly represented or entirely absent in the tropical region. For example, in the Kartabo region the Rosaceæ includes only 4 species and these are all woody; the Scrophulariaceæ 4; the Labiata 2; the Umbelliferæ 2, and both of these introductions along the coast; and the Cruciferæ a single introduction. The Gymnospermæ, Amentiferæ, Ranunculaceæ, and Ericaceæ, all well represented in the temperate area, are entirely without representation in the vicinity of Kartabo.

The species common to the two regions are necessarily few. Those found at Kartabo and also in western Pennsylvania are: *Syntherisma sanguinalis*, *Kyllinga pumila*, *Sinapis arvensis*, *Quamoclit vulgaris*, *Solanum nigrum*, *Erechtites hieracifolia* and *Mikania Parkeriana*. These forms, however, are widely distributed plants and their occurrence in both regions is of no special significance except in so far as it

shows the adaptability of the species themselves, and especially since they are not a characteristic part of the rain forest vegetation at Kartabo but occur in the region as weeds in clearings or cultivated tracts.

KEY TO THE FAMILIES

Division PTERIDOPHYTA

Plants without flowers and seeds; reproduction by spores (without embryos) which develop into flat or irregular prothallia, these bearing the reproductive organs (antheridia and archegonia); ferns, lycopods, horsetails, and their allies.

- a. Plants true ferns; fronds expanded, not scale- or needle-like (*FILICALES*):
 - b. Ferns epiphytic or terrestrial; spores uniform:
 - c. Plants small, fronds membranous; sporangia borne on thread-like projections along the margins of the fronds.
HYMENOPHYLLACEÆ, p. 82
 - cc. Plants large, fronds thick; sporangia not borne on thread-like projections:
 - d. Annulus vertical:
 - e. Sporangia sessile, or short-stalked; fronds pinnate.
CYATHEACEÆ, p. 83
 - ee. Sporangia long-stalked; fronds pinnate or palmate.
POLYPODIACEÆ, p. 84
 - dd. Annulus apical; sporangia sessile *SCHIZÆACEÆ*, p. 91
 - bb. Ferns aquatic, unfern-like in appearance; spores of two kinds.
SALVINIACEÆ, p. 92
 - aa. Plants not true ferns; fronds scale- or needle-like, not expanded (*EQUISETALES* and *LYCOPODIALES*):
 - b. Plants consisting largely of slender jointed herbaceous stems with whorls of scale-like appressed leaves at the joints. *EQUISETACEÆ*, p. 92
 - bb. Plants resembling large moss plants, with scale- or needle-like leaves:
 - c. Spores uniform; branches terete. *LYCOPODIACEÆ*, p. 92
 - cc. Spores of two kinds; branches flat. *SELAGINELLACEÆ*, p. 93

Division SPERMATOPHYTA

Plants with flowers and seeds; reproduction by seeds (with embryos) not developing into flat or irregular prothallia; microspore (pollen grain) developing into a tubular prothallium (pollen tube); megaspore (embryo sac) developing a minute prothallium, and, together with it, remaining enclosed in the megasporangium (ovule) which ripens into the seed; true flowering or seed plants.

Class MONOCOTYLEDONEÆ

Stems in cross section showing the vascular strands or fibers irregularly distributed throughout the pith; flower parts usually in 3's or 6's, never in 5's; embryo with a single cotyledon; leaves parallel veined.

a. Ovary superior:

b. Divisions of the perianth sepal-like or none; leaves often pinnately or palmately lobed:

c. Leaves plaited in the bud, when mature more or less deeply divided.

PALMÆ, p. 104

cc. Leaves not plaited in the bud, or rarely so, entire:

d. Flowers, at least the pistillate, arranged on a spadix:

e. Flower spike usually inclosed in a spathe; leaves not linear; plants terrestrial or epiphytic..... *ARACEÆ*, p. 108

ee. Flower spike not inclosed in a spathe; leaves linear; plants growing in wet soil or in water..... *TYPHACEÆ*, p. 94

dd. Flowers not arranged on a spadix:

e. Flowers inclosed or subtended by imbricated husk-like scales (glumes); grass-like plants with jointed stems; leaves sheathing:

f. Stems hollow, round or flattened; leaf-sheaths split; anthers attached by the middle..... *GRAMINEÆ*, p. 95

ff. Stems solid, usually more or less triangular; leaf-sheaths not split; anthers attached at the base..... *CYPERACEÆ*, p. 98

ee. Flowers not inclosed or subtended by imbricated husk-like scales, though sometimes in involucrate heads:

f. Immersed aquatics, branching and leafy, the upper leaves often floating..... *POTAMOGETONACEÆ*, p. 94

ff. Terrestrial or marsh plants..... *ERIOCAULACEÆ*, p. 110

bb. Divisions of the perianth, at least the inner ones, petal-like; leaves not pinnately or palmately lobed:

c. Perianth divisions of one kind, all petal-like:

d. Inflorescence with a basal spathe; aquatic plants with broad-petioled leaves..... *PONTEDERACEÆ*, p. 114

dd. Inflorescence without a spathe; terrestrial or marsh plants:

e. Leaves overlapping, as if astride..... *HÆMODORACEÆ*, p. 115

ee. Leaves not as above..... *LILIACEÆ*, p. 114

cc. Perianth divisions of two kinds, the inner petal-like, the outer sepal-like:

d. Stamens 1-3:

e. Ovary 2-3-celled; flowers corymbose; leaves usually broad, entire.

COMMELINACEÆ, p. 113

ee. Ovary 1-celled:

f. Flowers solitary; plants aquatic, moss-like, small and slender with small white flowers..... *MAYACACEÆ*, p. 109

ff. Flowers not solitary, capitate; plants aquatic, grass-like.

XYRIDACEÆ, p. 110

- dd. Stamens 4 or more:
 - e. Stigmas 3-5, sometimes twisted; fruit a septicidal capsule or berry; mostly epiphytic but sometimes terrestrial plants.
BROMELIACEÆ, p. 111
 - ee. Stigmas 1, rarely 2-4 and in this case unisexual, entire or lobed; fruit a loculicidal capsule, rarely an achene or nut; terrestrial plants.
RAPATEACEÆ, p. 111
- aa. Ovary inferior:
 - b. Fertile stamens 1, 2, or 5, usually adnate to the style; flowers irregular:
 - c. Plants mostly epiphytic; androecium composed of 1 fertile stamen, without staminodes, or with 2 minute staminodes, or of 2 fertile stamens with 1 staminode; seeds without endosperm. . . *ORCHIDACEÆ*, p. 121
 - cc. Plants terrestrial; androecium composed of 1 fertile stamen and 1-5 staminodes, at least part of these petal-like, or of 5 fertile stamens; seeds with endosperm:
 - d. Fertile stamens 5 *MUSACEÆ*, p. 117
 - dd. Fertile stamens 1-3:
 - e. Fertile stamens 3; ovule 1 in each cell of the ovary.
MARANTACEÆ, p. 119
 - ee. Fertile stamens 1; ovules several-many in each cell of the ovary:
 - f. Flowers regular; sepals united; anthers 2-celled.
ZINGIBERACEÆ, p. 118
 - ff. Flowers irregular; sepals distinct; anthers 1-celled.
CANNACEÆ, p. 119
 - bb. Fertile stamens 3, 6, or more, free from the style; flowers regular:
 - c. Plants scandent, with broad leaves; flowers unisexual.
DIOSCOREACEÆ, p. 116
 - cc. Plants not scandent, with narrow leaves; flowers perfect:
 - d. Perianth divisions unlike, the outer sepal-like.
BROMELIACEÆ, p. 111
 - dd. Perianth divisions all petal-like:
 - e. Ovary 3-chambered with axile placentation
AMARYLLIDACEÆ, p. 115
 - ee. Ovary 1-chambered with parietal placentation. . *TACCACEÆ*, p. 116

Class DICOTYLEDONEÆ

Stems in cross section showing a central pith surrounded by a circle or ring of vascular strands, these often merged into a zone of wood; flower parts usually in 4's or 5's; embryo with two cotyledons; leaves net-veined.

- a. Gynoecium composed of two or more separate or nearly quite separate carpels with separate styles and stigmas, rarely the free carpels immersed in the expanded torus as in the Nymphaeaceæ (*APOCARPÆ*) (aa p. 56):
- b. Petals present (bb p. 56):
- c. Petals free from each other, sometimes considerably modified (cc p. 56):

- d. Leaves opposite or verticillate, never all radical:
 - e. Herbs, sometimes slightly woody at the base, often succulent; leaves mostly connate at the base, without stipules.
CRASSULACEÆ, p. 141
 - ee. Trees, shrubs or woody climbers:
 - f. Carpels inserted at or near the base of the hollow calyx-tube.
MONIMIACEÆ, p. 138
 - ff. Carpels inserted on a more or less convex or slightly concave torus.
MALPIGHIACEÆ, p. 166
- dd. Leaves alternate or all radical:
 - e. Leaves stipulate, sometimes the stipules minute or adnate to the petiole, or inclosing the young buds:
 - f. Stamens free from one another or nearly so, or shortly united into separate bundles; calyx imbricate or valvate:
 - g. Woody plants:
 - h. Trees or shrubs. *ROSACEÆ*, p. 141
 - hh. Woody climbers. *DILLENACEÆ*, p. 189
 - gg. Herbs. *TILIACEÆ*, p. 184
 - ff. Stamens more or less united into a column; calyx valvate.
STERCULIACEÆ, p. 189
 - ee. Leaves without stipules:
 - f. Carpels completely sunk in the tissue of the large broad torus; aquatic plants with floating leaves. . . *NYMPHÆACEÆ*, p. 134
 - ff. Carpels not sunk in the tissue of the torus; plants not aquatic:
 - g. Stamens numerous, more than 12, or more than double the number of the petals:
 - h. Sepals and petals in 3, rarely in 2, distinct series:
 - i. Flowers mostly hermaphrodite; anthers with a broad truncate connective. *ANONACEÆ*, p. 136
 - ii. Flowers dioecious; anthers with a narrow connective.
MENISPERMACEÆ, p. 135
 - hh. Sepals and petals in two series or rarely the sepals gradually passing into the petals, usually in 4's or 5's, or rarely the petals numerous:
 - i. Petals and stamens hypogynous:
 - j. Calyx imbricate. *DILLENACEÆ*, p. 189
 - jj. Calyx valvate. *ANONACEÆ*, p. 136
 - ii. Petals and stamens perigynous. *ROSACEÆ*, p. 141
 - gg. Stamens 12 or fewer, or double the number of the petals when more than 6:
 - h. Leaves gland-dotted. *RUTACEÆ*, p. 163
 - hh. Leaves not gland-dotted:
 - i. Leaves compound:
 - j. Wood with resin ducts. *ANACARDIACEÆ*, p. 178
 - jj. Wood without resin ducts:
 - k. Seeds often arillate. *CONNARACEÆ*, p. 142
 - kk. Seeds not arillate. *ROSACEÆ*, p. 141

- ii. Leaves simple:
 - j. Flowers hermaphrodite:
 - k. Seeds arillate, aril entire, more or less cupular.
CONNARACEÆ, p. 142
 - kk. Seeds without an aril. . . . *ANACARDIACEÆ*, p. 178
 - jj. Flowers dioecious; petals and stamens in 3's or multiples of 3. *MENISPERMACEÆ*, p. 135
- cc. Petals more or less united:
 - d. Leaves simple:
 - e. Flowers dioecious; climbers. *MENISPERMACEÆ*, p. 135
 - ee. Flowers hermaphrodite; herbs or shrubs. . . *CRASSULACEÆ*, p. 141
 - dd. Leaves compound:
 - e. Leaves usually 3-foliolate; seeds not arillate. . . *RUTACEÆ*, p. 163
 - ee. Leaves pinnate; seeds often arillate. *CONNARACEÆ*, p. 142
- bb. Petals absent:
 - c. Leaves stipulate. *STERCULIACEÆ*, p. 189
 - cc. Leaves without stipules:
 - d. Stamens mostly with broad more or less truncate connective.
ANONACEÆ, p. 136
 - dd. Stamens usually with a narrow connective:
 - e. Stamens hypogynous:
 - f. Woody climbers. *MENISPERMACEÆ*, p. 135
 - ff. Herbs. *PHYTOLACCACEÆ*, p. 133
 - ee. Stamens more or less perigynous or on a widened or hollow calyx-tube. *MONIMIACEÆ*, p. 138
- aa. Gynoecium composed of 1 carpel or of 2 or more united carpels with free or united styles, or if carpels free below, then the styles or stigmas united
(*SYNCARPÆ*):
- b. Ovules attached to the wall or walls of the ovary
(*PARIETALES*) (bb p. 61):
- c. Ovary superior (cc p. 60):
- d. Petals present (dd p. 60):
- e. Petals free from each other (ee p. 59):
- f. Leaves opposite (ff p. 57):
 - g. Connective of the anthers produced above the cells; flowers often somewhat irregular, the lower petal often gibbous or saccate at the base. *VIOLACEÆ*, p. 197
- gg. Connective of the anthers not produced; flowers usually regular:
 - h. Stamens more than double the number of the petals:
 - i. Ovary stipitate. *LYTHRACEÆ*, p. 203
 - ii. Ovary sessile. *GUTTIFERÆ*, p. 194
 - hh. Stamens the same or double the number of the petals:
 - i. Corona present. *PASSIFLORACEÆ*, p. 200
 - ii. Corona absent:
 - j. Stamens and petals hypogynous.
FLACOURTIACEÆ, p. 198

- jj. Stamens and petals perigynous:
 - k. Stamens not diadelphous (in 2 bundles); flowers regular:
 - l. Styles free; stamens erect in the bud.
CRASSULACEÆ, p. 141
 - ll. Styles united; stamens often inflexed in the bud.
LYTHRACEÆ, p. 203
 - kk. Stamens diadelphous; flowers irregular.
PAPILIONACEÆ, p. 152
- ff. Leaves alternate or all radical:
 - g. Stamens numerous, more than 12 (gg. p. 58):
 - h. Filaments united:
 - i. Shrubs or trees; leaves pinnate. *MIMOSACEÆ*, p. 143
 - ii. Herbs; leaves simple *TILIACEÆ*, p. 184
 - hh. Filaments free or partially adnate to a gynophore or shortly connate only at the base:
 - i. Anthers opening by apical pores or short pore-like slits.
OCHNACEÆ, p. 190
 - ii. Anthers opening by longitudinal slits:
 - j. Flowers regular:
 - k. Stipules present, sometimes early deciduous, free or adnate to the petiole:
 - l. Corona absent:
 - m. Ovary of more than 1 carpel, i.e. with 2 or more placentas:
 - n. Petals and stamens hypogynous:
 - o. Leaves simple; sepals at length reflexed or deciduous. . . . *FLACOURTIACEÆ*, p. 198
 - oo. Leaves simple or pinnate; sepals not or rarely reflexed, not deciduous.
ANACARDIACEÆ, p. 178
 - nn. Petals and stamens perigynous.
ROSACEÆ, p. 141
 - mm. Ovary of 1 carpel, with 1 placenta.
DILLENIACEÆ, p. 189
 - ll. Corona present. *PASSIFLORACEÆ*, p. 200
 - kk. Stipules absent:
 - l. Trees, shrubs, or woody climbers:
 - m. Leaves simple:
 - n. Flowers mostly solitary. . . *ANONACEÆ*, p. 136
 - nn. Flowers rarely solitary, sometimes spicate-racemose. *FLACOURTIACEÆ*, p. 198
 - mm. Leaves pinnate *MIMOSACEÆ*, p. 143
 - ll. Herbs. *CRUCIFERÆ*, p. 140
 - jj. Flowers irregular:
 - k. Odd petal adaxial. *PAPILIONACEÆ*, p. 152
 - kk. Odd petal not adaxial. . . . *CÆSALPINIACEÆ*, p. 147

gg. Stamens 12 or fewer:

h. Stamens 6, tetradynamous (4 long and 2 short); flowers 4-parted. *CRUCIFERÆ*, p. 140

hh. Stamens not as above, rarely 6; flowers rarely 4-parted:

i. Flowers markedly irregular:

j. Shrubs or trees; anthers often with produced connective, mostly connivent or connate around the style.

VIOLACEÆ, p. 197

jj. Herbs, shrubs or trees; anther connective not produced or only glandular:

k. Odd petal adaxial; corolla of standard, wings and keel.

PAPILIONACEÆ, p. 152

kk. Odd petal not adaxial; corolla not as above:

l. Fruit a legume. *CÆSALPINIACEÆ*, p. 147

ll. Fruit not a legume. *POLYGALACEÆ*, p. 172

ii. Flowers regular or nearly so:

j. Flowers with a distinct corona.

PASSIFLORACEÆ, p. 200

jj. Flowers without a corona:

k. Stamens united with the anthers in a ring around the apex of the column. *MENISPERMACEÆ*, p. 135

kk. Stamens free or united only at the base or rarely only the anthers connivent:

l. Leaves stipulate:

m. Anthers with the connective produced above the cells:

n. Anthers connivent around the style.

VIOLACEÆ, p. 197

nn. Anthers not connivent around the style.

FLACOURTIACEÆ, p. 198

mm. Anthers without a produced connective:

n. Staminodes present, sometimes petaloid.

OCHNACEÆ, p. 190

nn. Staminodes absent:

o. Herbs; leaves with numerous very sticky gland-tipped hairs. *DROSERACEÆ*, p. 140

oo. Shrubs or trees; leaves without sticky hairs.

FLACOURTIACEÆ, p. 198

ll. Leaves without stipules:

m. Flowers in heads or dense spikes; ovary of 1 carpel; ovules more than 1. *MIMOSACEÆ*, p. 143

mm. Flowers not in heads or dense spikes:

n. Ovary of more than 1 carpel, ovule solitary.

ANACARDIACEÆ, p. 178

nn. Ovary of 5 carpels with numerous ovules.

CARICACEÆ, p. 202

- ee. Petals more or less united:
- f. Stamens free from the corolla tube:
- g. Ovary composed of more than 1 carpel:
- h. Leaves opposite..... *MELASTOMACEÆ*, p. 208
- hh. Leaves alternate or radical:
- i. Stamens numerous..... *ANONACEÆ*, p. 136
- ii. Stamens definite:
- j. Stamens 5; leaves radical, with glandular hairs.
DROSERACEÆ, p. 140
- jj. Stamens 4; leaves not radical with glandular hairs.
POLYGALACEÆ, p. 172
- gg. Ovary composed of a single carpel; stamens free or more usually diadelphous (in 2 bundles) or monadelphous (in 1 bundle), often 10, rarely numerous:
- h. Stamens connate into a sheath, or free; flowers mostly hermaphrodite; fruit a legume:
- i. Flowers regular; petals valvate; calyx gamosepalous or valvate; leaves usually bipinnate, rarely simply pinnate or reduced to phyllodes..... *MIMOSACEÆ*, p. 143
- ii. Flowers irregular, or rarely regular; sepals imbricate or rarely valvate; petals imbricate, the upper (adaxial) one inside the others; leaves often pinnate or bipinnate.
CÆSALPINIACEÆ, p. 147
- iii. Flowers irregular; petals imbricate, the upper (adaxial) one (the standard) outside the others, the lateral two (the wings) outside the abaxial pair (the keel) which are more or less united along their lower edges; leaves simple, digitate or simply pinnate.
PAPILIONACEÆ, p. 152
- hh. Stamens connate into a column with the anthers in a ring at the top; flowers dioecious; fruit a drupe.
MENISPERMACEÆ, p. 135
- ff. Stamens inserted on the corolla tube, sometimes near the base:
- g. Stamens double the number of the corolla lobes:
- h. Flowers irregular..... *POLYGALACEÆ*, p. 172
- hh. Flowers regular..... *CARICACEÆ*, p. 202
- gg. Stamens the same number as the corolla lobes; flowers regular or nearly so (see ggg):
- h. Carpels more or less free:
- i. Style simple; pollen granular..... *APOCYNACEÆ*, p. 230
- ii. Styles 2, separate up to the common thickened apex; pollen agglutinated into masses.
ASCLEPIADACEÆ, p. 234
- hh. Carpels connate into a 1- or 2-celled ovary:
- i. Stamens 5; ovules numerous..... *GENTIANACEÆ*, p. 228
- ii. Stamens 4:
- j. Ovules numerous..... *BIGNONIACEÆ*, p. 247

- jj. Ovules 1-2 in each cell. *VERBENACEÆ*, p. 240
- ggg. Stamens fewer than the corolla lobes, 2 or 4; flowers irregular or rarely subregular:
 - h. Ovules numerous on each placenta:
 - i. Trees or woody vines; seeds winged.
 - BIGNONIACEÆ*, p. 247
 - ii. Herbs; seeds not winged. *GESNERIACEÆ*, p. 250
 - hh. Ovules 1-2 on each placenta. *VERBENACEÆ*, p. 240
- dd. Petals absent:
 - e. Ovary composed of 1 carpel:
 - f. Stamens more than 4; sepals not or rarely valvate:
 - g. Stamens 10 or fewer by abortion:
 - h. Anthers erect in the bud. *ULMACEÆ*, p. 128
 - hh. Anthers inflexed in the bud. *MORACEÆ*, p. 128
 - gg. Stamens numerous. *FLACOURTIACEÆ*, p. 198
 - ff. Stamens 4, opposite the valvate calyx segments.
 - PROTEACEÆ*, p. 130
 - ee. Ovary composed of more than 1 carpel, at least with 2 or more placentas or more than 1 ovule:
 - f. Stamens hypogynous or flowers unisexual.
 - FLACOURTIACEÆ*, p. 198
 - ff. Stamens distinctly perigynous:
 - g. Anthers inflexed in the bud; filaments free.
 - LYTHRACEÆ*, p. 203
 - gg. Anthers not inflexed in the bud; filaments rarely free.
 - PROTEACEÆ*, p. 130
 - cc. Ovary inferior:
 - d. Petals present:
 - e. Petals free from each other (see p. 70):
 - f. Aquatic herbs with usually floating leaves.
 - NYMPHÆACEÆ*, p. 134
 - ff. Not aquatic, rarely marsh plants:
 - g. Flowers hermaphrodite:
 - h. Anthers opening by pores; leaves opposite, with parallel main nerves. *MELASTOMACEÆ*, p. 208
 - hh. Anthers not opening by pores:
 - i. Stamens numerous, more than twice as many as the petals; trees or shrubs. *MYRTACEÆ*, p. 206
 - ii. Stamens definite; herbs or low shrubs.
 - ONAGRACEÆ*, p. 222
 - gg. Flowers unisexual. *CUCURBITACEÆ*, p. 267
 - ee. Petals more or less united:
 - f. Flowers unisexual. *CUCURBITACEÆ*, p. 267
 - ff. Flowers hermaphrodite:
 - g. Leaves stipulate. *RUBIACEÆ*, p. 254
 - gg. Leaves without stipules. *GESNERIACEÆ*, p. 250
 - dd. Petals absent. *MYRTACEÆ*, p. 206

- bb. Ovules attached to the central axis or to the base or apex of the ovary
(*AXILES*):
- c. Ovary superior (cc p. 78):
- d. Petals present (dd p. 75):
- e. Petals free from each other (ee p. 70):
- f. Perfect stamens the same number as the petals and opposite to them:
- g. Leaves not gland-dotted:
- h. Calyx lobes or sepals imbricate..... *VITACEÆ*, p. 183
- hh. Calyx lobes valvate:
- i. Disk absent from the flowers:
- j. Leaves stipulate; stamens hypogynous.
STERCULIACEÆ, p. 189
- jj. Leaves without stipules; stamens perigynous.
LYTHRACEÆ, p. 203
- ii. Disk present..... *OLACACEÆ*, p. 131
- gg. Leaves pellucid-punctate:
- h. Leaves simple; trees or shrubs..... *MYRSINACEÆ*, p. 224
- hh. Leaves compound; climbers..... *VITACEÆ*, p. 183
- ff. Perfect stamens the same number as the petals, and alternate with them or more numerous, very rarely fewer:
- g. Style basal:
- h. Leaves simple; stamens numerous..... *ROSACEÆ*, p. 141
- hh. Leaves pinnate; stamens 10..... *SIMARUBACEÆ*, p. 164
- gg. Style or styles terminal or subterminal, sometimes gynobasic:
- h. Flowers markedly irregular:
- i. Stamens definite in number, 12 or fewer:
- j. Lower sepal not spurred..... *POLYGALACEÆ*, p. 172
- jj. Lower sepal more or less elongated into a spur.
VOCHYSIACEÆ, p. 171
- ii. Stamens more than 12..... *ROSACEÆ*, p. 141
- hh. Flowers regular or very slightly irregular:
- i. Stamens united into more than 1 separate bundle, often opposite the petals (ii p. 62):
- j. Leaves opposite, often gland-dotted or with resinous lines, without stipules..... *GUTTIFERÆ*, p. 194
- jj. Leaves alternate (or if opposite then stipulate) or all radical:
- k. Sepals imbricate:
- l. Trees or shrubs... *TERNSTROEMIACEÆ*, p. 194
- ll. Climbing shrubs..... *DILLENACEÆ*, p. 189
- kk. Sepals valvate:
- l. Stamens free or monadelphous, or if united into bundles then some sterile.
STERCULIACEÆ, p. 189
- ll. Stamens in separate bundles, all fertile.
TILIACEÆ, p. 184

- ii. Stamens free or at least not united into several bundles, sometimes more or less united at the base or into 1 bundle (monadelphous):
 - j. Leaves opposite or verticillate or very rarely fasciculate, never all radical nor completely reduced (jj p. 65):
 - k. Leaves compound, rarely unifoliolate and then with a distinctly tumid petiole, sometimes sessile:
 - l. Stamens numerous, more than twice the number of the petals. *CARYOCARACEÆ*, p. 192
 - ll. Stamens definite, not more than twice the number of the petals:
 - m. Leaves gland-dotted. *RUTACEÆ*, p. 163
 - mm. Leaves not gland-dotted:
 - n. Stamens with free filaments, mostly twice as many as the petals:
 - o. Ovules mostly 2 in each cell.
 - BURSERACEÆ*, p. 164
 - SIMARUBACEÆ*, p. 164
 - nn. Stamens with more or less connate filaments, often double the number of the petals.
 - MELIACEÆ*, p. 165
 - kk. Leaves simple, but sometimes deeply and variously divided:
 - l. Ovary stipitate on a gynophore. . . *RUTACEÆ*, p. 163
 - ll. Ovary sessile or rarely very slightly stipitate:
 - m. Stamens more than twice as many as the petals:
 - n. Calyx imbricate or calyptrate:
 - o. Stipules absent. *GUTTIFERÆ*, p. 194
 - oo. Stipules present.
 - TERNSTROEMIACEÆ*, p. 194
 - nn. Calyx valvate:
 - o. Stamens free or very shortly connate at the base:
 - p. Stamens not inflexed in the bud:
 - q. Stipules paired, not interpetiolar.
 - TILIACEÆ*, p. 184
 - qq. Stipules single, interpetiolar.
 - RHIZOPHORACEÆ*, p. 204
 - pp. Stamens inflexed in the bud:
 - q. Leaves stipulate; indumentum often stellate. . . . *EUPHORBIACEÆ*, p. 173
 - qq. Leaves without stipules; indumentum rarely stellate. . . *LYTHRACEÆ*, p. 203
 - oo. Stamens monadelphous or in fascicles opposite the petals, the latter contorted or imbricate. *STERCULIACEÆ*, p. 189

mm. Stamens not more than twice as many as the petals:

n. Trees, shrubs or woody climbers (nn p. 64):

o. Leaves stipulate, sometimes stipules rudimentary or of hairs:

p. Stipules intrapetiolar, often connivent into 1 or adnate to the petiole:

q. Sepals not glandular outside and not accrescent in fruit; hairs not medifixed. *ERYTHROXYLACEÆ*, p. 163

qq. Sepals usually glandular outside or accrescent in fruit; hairs medifixed.

MALPIGHIACEÆ, p. 166

pp. Stipules not intrapetiolar, sometimes rudimentary:

q. Disk absent or inconspicuous or of separate glands; calyx often glandular:

r. Stamens free or shortly united only at the base. *MALPIGHIACEÆ*, p. 166

rr. Stamens united into a long tube.

RHIZOPHORACEÆ, p. 204

qq. Disk present, conspicuous; calyx not glandular:

r. Flowers hermaphrodite:

s. Stamens inserted on or below the margin of the disk; filaments subulate:

t. Stamens 3-5.

CELASTRACEÆ, p. 180

tt. Stamens 8-10.

RHIZOPHORACEÆ, p. 204

ss. Stamens usually 3, inserted on the disk; filaments flattened or connivent, often adnate to the ovary.

HIPPOCRATEACEÆ, p. 181

rr. Flowers unisexual.

EUPHORBIACEÆ, p. 173

oo. Leaves without stipules or stipules gland-like:

p. Stamens united into a tube:

q. Stamens more than 4; flowers hermaphrodite. *MELIACEÆ*, p. 165

qq. Stamens 4; flowers unisexual.

GUTTIFERÆ, p. 194

pp. Stamens free or very shortly united only at the base:

q. Anthers opening at the apex by a pore or pores. . *MELASTOMACEÆ*, p. 208

qq. Anthers opening by slits lengthwise:

r. Ovules numerous in each cell:

s. Stamens and petals hypogynous;
flowers unisexual.

GUTTIFERÆ, p. 194

ss. Stamens and petals perigynous;
flowers hermaphrodite.

LYTHRACEÆ, p. 203

rr. Ovules few in each cell:

s. Sepals 2-glandular outside; hairs,
when present, on the leaves medi-
fixed. . *MALPIGHIACEÆ*, p. 166

ss. Sepals not glandular; hairs not
medifixed:

t. Ovules pendulous from the apex of
the cells.

COMBRETACEÆ, p. 205

tt. Ovules erect or ascending from
the base of the cells:

u. Calyx imbricate:

v. Filaments subulate or fili-
form:

w. Flowers hermaphrodite.

CELASTRACEÆ, p. 180

ww. Flowers dioecious or poly-
gamous.

GUTTIFERÆ, p. 194

vv. Filaments flattened.

HIPPOCRATEACEÆ, p. 181

uu. Calyx valvate:

v. Leaves not gland-dotted:

w. Sepals free or nearly so.

ANACARDIACEÆ, p. 178

ww. Sepals united into a long
tube; the 2 petals next
the axis often larger than
the others.

LYTHRACEÆ, p. 203

vv. Leaves gland-dotted.

RUTACEÆ, p. 163

nn. Herbs, sometimes woody at the base:

o. Leaves with 3 or more longitudinally parallel
nerves; anthers usually appendaged and
opening by a terminal pore.

MELASTOMACEÆ, p. 208

- oo. Leaves not as above; anthers opening by longitudinal slits:
 - p. Anthers erect in the bud.
 - AIZOACEÆ*, p. 134
 - pp. Anthers inflexed in the bud.
 - LYTHRACEÆ*, p. 203
- jj. Leaves alternate or all radical:
 - k. Stamens more than twice the number of the sepals or petals (kk p. 67):
 - l. Sepals valvate or open in the bud:
 - m. Anthers 2-celled:
 - n. Stamens free or slightly united only at the base:
 - o. Petals and stamens hypogynous or flowers unisexual:
 - p. Flowers hermaphrodite; indumentum often stellate *TILIACEÆ*, p. 184
 - pp. Flowers unisexual; indumentum rarely stellate *EUPHORBIACEÆ*, p. 173
 - oo. Petals and stamens perigynous or epigynous:
 - p. Anthers inflexed in the bud; calyx tubular.
 - LYTHRACEÆ*, p. 203
 - pp. Anthers erect in the bud:
 - q. Leaves simple; wood not resinous.
 - OLACACEÆ*, p. 131
 - qq. Leaves compound or unifoliolate; wood resinous. . . *ANACARDIACEÆ*, p. 178
 - nn. Stamens more or less united into a tube or into bundles, hypogynous.
 - STERCULIACEÆ*, p. 189
 - mm. Anthers 1-celled; stamens monadelphous:
 - n. Trees; leaves digitately compound.
 - BOMBACACEÆ*, p. 188
 - nn. Herbs or low shrubs; leaves simple.
 - MALVACEÆ*, p. 184
 - ll. Sepals imbricate or rarely completely connate or calyptrate or cupulate:
 - m. Petals and stamens perigynous:
 - n. Leaves stipulate *ROSACEÆ*, p. 141
 - nn. Leaves without stipules. . *LYTHRACEÆ*, p. 203
 - mm. Petals and stamens more or less hypogynous or flowers unisexual; disk often present:
 - n. Trees, shrubs or woody climbers (nn p. 67):
 - o. Leaves compound or rarely unifoliolate and then with a tumid petiole (oo p. 66):
 - p. Leaves pinnate; petals not calyptrate:

- q. Ovule ascending:
 - r. Leaves gland-dotted; style or styles central *RUTACEÆ*, p. 163
 - rr. Leaves rarely gland-dotted; styles or stigmas often separated:
 - s. Wood resinous.
 - ANACARDIACEÆ*, p. 178
 - ss. Wood not resinous:
 - t. Wood not bitter.
 - SAPINDACEÆ*, p. 182
 - tt. Wood very bitter.
 - SIMARUBACEÆ*, p. 164
 - qq. Ovule or ovules pendulous:
 - r. Stamens free:
 - s. Wood resinous.
 - ANACARDIACEÆ*, p. 178
 - ss. Wood not resinous.
 - SIMARUBACEÆ*, p. 164
 - rr. Stamens united into a tube.
 - MELIACEÆ*, p. 165
 - pp. Leaves digitate 3-5-foliolate; petals calyptrately connate.
 - CARYOCARACEÆ*, p. 192
- oo. Leaves simple or palmately divided:
 - p. Leaves stipulate:
 - q. Flowers unisexual:
 - r. Disk present.
 - EUPHORBIACEÆ*, p. 173
 - rr. Disk absent.
 - FLACOURTIACEÆ*, p. 198
 - qq. Flowers hermaphrodite.
 - OCHNACEÆ*, p. 190
 - pp. Leaves without stipules:
 - q. Seeds arillate; ovary of 1 carpel.
 - DILLENIACEÆ*, p. 189
 - qq. Seeds not arillate; ovary of 2 or more carpels:
 - r. Sterile flowers with modified pitcher-like saccate or spurred bracts.
 - MARCGRAVIACEÆ*, p. 192
 - rr. Sterile flowers not present; no modified bracts:
 - s. Anthers basifixed; seeds usually few.
 - TERNSTROEMIACEÆ*, p. 194
 - ss. Anthers versatile; seeds numerous, small. . . . *HUMIRIACEÆ*, p. 163

- nn. Herbs:
 - o. Plants with glandular hairs.
DROSERACEÆ, p. 140
 - oo. Plants without glandular hairs.
NYMPHÆACEÆ, p. 134
- kk. Stamens definite in number in relation to the sepals or petals, often the same number or twice as many or fewer:
 - l. Leaves compound, rarely unifoliolate and then with a distinctly tumid petiole:
 - m. Stamens united into a tube. *MELIACEÆ*, p. 165
 - mm. Stamens free or united only at the base:
 - n. Leaves gland-dotted. *RUTACEÆ*, p. 163
 - nn. Leaves not gland-dotted:
 - o. Ovules pendulous from towards the apex of the cells:
 - p. Ovary of more than 1 carpel:
 - q. Wood resinous. *BURSERACEÆ*, p. 164
 - qq. Wood not resinous.
SIMARUBACEÆ, p. 164
 - pp. Ovary of 1 carpel.
ANACARDIACEÆ, p. 178
 - oo. Ovules ascending or horizontal:
 - p. Style simple:
 - q. Ovary 1-celled, ovules 2, collateral.
CONNARACEÆ, p. 142
 - qq. Ovary 2-5-celled, ovules 1-2 or more.
MELIACEÆ, p. 165
 - qqq. Ovary 3-celled, ovule 1, ascending.
SAPINDACEÆ, p. 182
 - pp. Style or styles not simple:
 - q. Ovule 1 in each cell.
ANACARDIACEÆ, p. 178
 - qq. Ovules 2 in each cell, superposed.
RUTACEÆ, p. 163
 - ll. Leaves simple, rarely completely reduced:
 - m. Anthers opening by valves. *LAURACEÆ*, p. 138
 - mm. Anthers opening by terminal pores (see mmm):
 - n. Ovary deeply lobed; torus enlarging in fruit and the carpels often becoming separate.
OCHNACEÆ, p. 190
 - nn. Ovary not deeply lobed; torus not enlarged.
POLYGALACEÆ, p. 172
- mmm. Anthers opening by slits lengthwise:
 - n. Shrubs or trees (nn p. 70):
 - o. Leaves stipulate (oo p. 68):

- p. Flowers unisexual:
 - q. Petals bilobed.
DICHA PETALACEÆ, p. 173
 - qq. Petals not bilobed:
 - r. Disk absent.
FLACOURTIACEÆ, p. 198
 - rr. Disk present:
 - s. Stipules conspicuous, persistent.
EUPHORBIACEÆ, p. 173
 - ss. Stipules very inconspicuous, deciduous.*CELA STRACEÆ*, p. 180
 - pp. Flowers hermaphrodite:
 - q. Stamens perigynous, inserted on the calyx tube.*ROSACEÆ*, p. 141
 - qq. Stamens hypogynous or inserted on or at the base of a disk:
 - r. Stipules axillary, convolute in the bud, often very long.
ERYTHROXYLACEÆ, p. 163
 - rr. Stipules not axillary:
 - s. Disk absent, or torus sometimes enlarging in fruit but not glandular:
 - t. Stamens 10:
 - u. Stamens in 2 series; hairs of leaves when present not modified.
ERYTHROXYLACEÆ, p. 163
 - uu. Stamens in 1 series; hairs of leaves modified.
MALPIGHIACEÆ, p. 166
 - tt. Stamens numerous.
OCHNACEÆ, p. 190
 - ss. Disk present, annular or of separate glands:
 - t. Petals entire or emarginate; ovules erect.*CELA STRACEÆ*, p. 180
 - tt. Petals often deeply lobed; ovules pendulous.
DICHA PETALACEÆ, p. 173
 - oo. Leaves without stipules:
 - p. Stamens united into a tube.
MELIACEÆ, p. 165
 - pp. Stamens free or connate only at the base:
 - q. Stamens hypogynous or very slightly perigynous (qq p. 70):

- r. Sterile flowers with modified pitcher-like bracts.

MARCGRAVIACEÆ, p. 192

- rr. Sterile flowers without modified bracts, or sterile flowers not present:

- s. Stamens double the number of the petals or fewer only by abortion of some anthers:

- t. Sepals usually with 2 large glands outside; hairs of leaves medifixed.

MALPIGHIACEÆ, p. 166

- tt. Sepals not glandular; hairs rarely medifixed:

- u. Ovary 1-celled.

ANACARDIACEÆ, p. 178

- uu. Ovary completely 2- or more-celled (or nearly completely 5-celled):

- v. Leaves gland-dotted.

RUTACEÆ, p. 163

- vv. Leaves not gland-dotted:

- w. Disk present, usually intrastaminal.

HUMIRIACEÆ, p. 163

- ww. Disk present, usually not intrastaminal:

- x. Flowers hermaphrodite.

OLACACEÆ, p. 131

- xx. Flowers polygamo-dioecious.

SAPINDACEÆ, p. 182

- ss. Stamens the same number as the petals or fewer:

- t. Disk absent; flowers polygamous:

- u. Petals imbricate, not clawed; anthers opening by an apical pore.

TERNSTROEMIACEÆ, p. 194

- uu. Petals imbricate, sessile; anthers opening by slits lengthwise.

AQUIFOLIACEÆ, p. 180

- tt. Disk present:

- u. Petals valvate.

OLACACEÆ, p. 131

- uu. Petals imbricate or contorted:

- v. Leaves not gland-dotted:

- w. Stamens usually 5:
 - x. Ovule solitary; wood resinous.
ANACARDIACEÆ, p. 178
 - xx. Ovules mostly 2 in each cell; wood not resinous.
CELASTRACEÆ, p. 180
 - ww. Stamens 3, with flattened filaments.
HIPPOCRATEACEÆ, p. 181
 - vv. Leaves gland-dotted.
RUTACEÆ, p. 163
 - qq. Stamens distinctly perigynous.
LYTHRACEÆ, p. 203
- nn. Herbs, rarely slightly woody at the base:
 - o. Leaves with glandular, sticky hairs.
DROSERACEÆ, p. 140
 - oo. Leaves not sticky glandular:
 - p. Leaves stipulate:
 - q. Stamens and petals hypogynous or flowers unisexual:
 - r. Flowers hermaphrodite.
TILIACEÆ, p. 184
 - rr. Flowers unisexual.
EUPHORBIACEÆ, p. 173
 - qq. Stamens and petals perigynous; anthers inflexed in the bud.
LYTHRACEÆ, p. 203
 - pp. Leaves without stipules:
 - q. Carpels with a gland or scale at the base; anthers erect in the bud.
CRASSULACEÆ, p. 141
 - qq. Carpels without a gland or scale; anthers inflexed in the bud.
LYTHRACEÆ, p. 203
- ee. Petals more or less united:
 - f. Stamens the same number as and opposite the corolla lobes:
 - g. Ovules solitary in the whole ovary or in each cell of the ovary; style often lobed:
 - h. Trees or shrubs, often with hard wood:
 - i. Petals imbricate; hairs often stellate or medifixed.
SAPOTACEÆ, p. 226
 - ii. Petals valvate; hairs usually simple.*OLACACEÆ*, p. 131
 - hh. Herbs or climbers:
 - i. Corolla lobes valvate.*VITACEÆ*, p. 183
 - ii. Corolla lobes imbricate.*MENISPERMACEÆ*, p. 135

- gg. Ovules 2 or more in each cell; style undivided; placentas often basal:
 - h. Trees or shrubs *MYRSINACEÆ*, p. 224
 - hh. Climbers *VITACEÆ*, p. 183
- ff. Stamens the same number as the corolla lobes and alternate with them or more numerous or fewer:
 - g. Stamens more than twice as many as the corolla lobes:
 - h. Flowers hermaphrodite:
 - i. Leaves simple, sometimes deeply divided:
 - j. Bracts more or less pouch-like and adnate to the pedicels; stems climbing or epiphytic.
MARCGRAVIACEÆ, p. 192
 - jj. Bracts and habit not as above:
 - k. Stamens hypogynous:
 - l. Sepals imbricate . . . *TERNSTROEMIACEÆ*, p. 194
 - ll. Sepals valvate:
 - m. Stamens free or nearly so *TILIACEÆ*, p. 184
 - mm. Stamens monadelphous *MALVACEÆ*, p. 184
 - kk. Stamens perigynous or epigynous; sepals usually imbricate *LECYTHIDACEÆ*, p. 203
 - ii. Leaves digitately compound . . . *CARYOCARACEÆ*, p. 192
 - hh. Flowers unisexual *EUPHORBIACEÆ*, p. 173
 - gg. Stamens as many as or up to twice as many as the corolla lobes or fewer:
 - h. Stamens as many as or more than the corolla lobes (hh p. 74):
 - i. Flowers irregular:
 - j. Ovary deeply 4-lobed; style gynobasic. *LABIATÆ*, p. 243
 - jj. Ovary not 4-lobed; style not gynobasic:
 - k. Ovules numerous:
 - l. Corolla lobes induplicate or contorted.
SOLANACEÆ, p. 243
 - ll. Corolla lobes imbricate or folded.
SCROPHULARIACEÆ, p. 246
 - kk. Ovules few:
 - l. Anthers 2-celled, opening by a longitudinal slit.
VERBENACEÆ, p. 240
 - ll. Anthers 1-2-celled, opening by a terminal pore.
POLYGALACEÆ, p. 172
 - ii. Flowers regular:
 - j. Leaves opposite or verticillate, mostly without stipules (jj p. 72):
 - k. Anthers opening by apical pores or pore-like slits:
 - l. Filaments of the stamens often jointed and inflexed; leaves mostly with the main nerves longitudinally parallel . . . *MELASTOMACEÆ*, p. 208
 - ll. Filaments not as above; leaves without longitudinally parallel nerves . . . *GENTIANACEÆ*, p. 228

kk. Anthers opening by longitudinal slits:

l. Leaves gland-dotted or pustulate; petals usually shortly tubular:

m. Stamens epipetalous. *LOGANIACEÆ*, p. 228

mm. Stamens not epipetalous. *RUTACEÆ*, p. 163

ll. Leaves not gland-dotted; petals usually joined high up:

m. Style single with often a large more or less capitate stigma:

n. Pollen granular; leaves stipulate or sheathing at the base (see nnn):

o. Climbing shrubs; leaves often stipulate.

LOGANIACEÆ, p. 228

oo. Herbs, shrubs or scramblers; leaves not stipulate. *SOLANACEÆ*, p. 243

nn. Pollen agglutinated in wax-like masses; leaves without stipules; corolla with a corona.

ASCLEPIADACEÆ, p. 234

nnn. Pollen granular; leaves without stipules; corolla without a corona:

o. Corolla lobes contorted or rarely valvate.

APOCYNACEÆ, p. 230

oo. Corolla lobes imbricate:

p. Leaves not verticillate.

SCROPHULARIACEÆ, p. 246

pp. Leaves verticillate. *VERBENACEÆ*, p. 240

mm. Style with several separate stigmas:

n. Stamens double the number of the corolla lobes; petals united only at the base.

LYTHRACEÆ, p. 203

nn. Stamens the same number as the corolla lobes:

o. Trees or shrubs:

p. Ovules numerous in each cell, or if solitary then corolla lobes valvate.

LOGANIACEÆ, p. 228

pp. Ovules 1-2 in each cell; corolla lobes imbricate. *VERBENACEÆ*, p. 240

oo. Herbs or herbaceous climbers:

p. Ovary imperfectly celled by the intrusive parietal placentas.

GENTIANACEÆ, p. 228

pp. Ovary perfectly celled with axile placentas.

SOLANACEÆ, p. 243

jj. Leaves alternate or all radical or reduced to scales:

k. Leafless parasites destitute of chlorophyll; flowers hermaphrodite. *CONVOLVULACEÆ*, p. 235

kk. Not parasitic or rarely so; leaves more or less green and normally developed:

- l. Leaves stipulate, stipules sometimes deciduous:
 - m. Leaves viscid-glandular. *DROSERACEÆ*, p. 140
 - mm. Leaves not viscid-glandular:
 - n. Flowers unisexual; petals not bifid.
 - EUPHORBIACEÆ*, p. 173
 - nn. Flowers hermaphrodite or unisexual; petals bifid or bilobed. *DICHAPETALACEÆ*, p. 173
- ll. Leaves without stipules:
 - m. Stamens hypogynous or perigynous, free from the corolla or slightly adnate to its base:
 - n. Stamens 4-6:
 - o. Leaves gland-dotted; ovary mostly deeply lobed. *RUTACEÆ*, p. 163
 - oo. Leaves not gland-dotted; ovary mostly entire:
 - p. Petals only slightly united at the base:
 - q. Disk present in the flowers, usually conspicuous. *OLACACEÆ*, p. 131
 - qq. Disk absent, or if present, adherent to the ovary:
 - r. Ovules numerous.
 - MARCGRAVIACEÆ*, p. 192
 - rr. Ovules 1-2 in each cell:
 - s. Leaves simple.
 - AQUIFOLIACEÆ*, p. 180
 - ss. Leaves pinnate.
 - CONNARACEÆ*, p. 142
 - pp. Petals united high up, sometimes free at the base. *BURSERACEÆ*, p. 164
 - nn. Stamens more than 6:
 - o. Stamens connate into a tube.
 - MELIACEÆ* p. 165
 - oo. Stamens free or slightly connate only at the base:
 - p. Leaves gland-dotted, often compound.
 - RUTACEÆ*, p. 163
 - pp. Leaves not gland-dotted, simple or rarely compound:
 - q. Disk present in the flowers:
 - r. Leaves simple; bark not bitter.
 - OLACACEÆ*, p. 131
 - rr. Leaves compound or unifoliolate; bark usually bitter.
 - SIMARUBACEÆ*, p. 164
 - qq. Disk absent. . . *AQUIFOLIACEÆ*, p. 180
 - mm. Stamens inserted on the corolla tube or in a column adnate to the stigma:

- n. Corolla valvate or plaited in the bud, in the latter case the limb may be somewhat twisted but not truly imbricate:
 - o. Ovules 1-4 in each ovary cell.
CONVOLVULACEÆ, p. 235
 - oo. Ovules numerous in each ovary cell:
 - p. Flowers with a corona; pollen agglutinated in wax-like masses.
ASCLEPIADACEÆ, p. 234
 - pp. Flowers without a corona; pollen not agglutinated in wax-like masses.
SOLANACEÆ, p. 243
- nn. Corolla imbricate or contorted in the bud:
 - o. Corolla contorted; ovary 1-2-celled:
 - p. Pollen agglutinated in wax-like masses.
ASCLEPIADACEÆ, p. 234
 - pp. Pollen not agglutinated in wax-like masses.
APOCYNACEÆ, p. 230
 - oo. Corolla imbricate; ovary 1-2, rarely 5-celled:
 - p. Herbs:
 - q. Style undivided or very shortly lobed.
GENTIANACEÆ, p. 228
 - qq. Style undivided; stigmas terminal, small or more or less dilated.
SOLANACEÆ, p. 243
 - pp. Trees or shrubs; fruit a pyrene or nut.
BORAGINACEÆ, p. 239
- hh. Stamens fewer than the corolla lobes:
 - i. Flowers regular:
 - j. Stamens more than 1:
 - k. Ovules numerous:
 - l. Ovary constantly and completely 2-celled:
 - m. Corolla lobes induplicate or contorted plaited.
SOLANACEÆ, p. 243
 - mm. Corolla lobes imbricate.
SCROPHULARIACEÆ, p. 246
 - ll. Ovary 1-celled or imperfectly 2-celled by the intrusive placentas.....*GESNERIACEÆ*, p. 250
 - kk. Ovules 1-2 in each cell of the ovary:
 - l. Corolla lobes about 3 times as many as the calyx lobes.....*SAPOTACEÆ*, p. 226
 - ll. Corolla lobes not more than the calyx lobes.
VERBENACEÆ, p. 240
 - jj. Stamen 1.....*LOGANIACEÆ*, p. 228
- ii. Flowers irregular:
 - j. Aquatic or swamp plants; placenta free-basal, more or less globose.....*LENTIBULARIACEÆ*, p. 251

- jj. Not aquatic; placenta axile, or if subbasal then ovules very few:
- k. Ovules numerous in the whole ovary or in each cell of the ovary, or if 2 then superposed:
 - l. Anthers connivent or coherent:
 - m. Seeds often winged, transverse, ovary mostly 2-celled and then the cells ad- and ab-axial.
BIGNONIACEÆ, p. 247
 - mm. Seeds not winged:
 - n. Ovary imperfectly 2-celled by the variously intrusive parietal placentas, the latter placed right and left of the floral axis.
GESNERIACEÆ, p. 250
 - nn. Ovary 1-4-celled:
 - o. Herbs or rarely shrubs.
ACANTHACEÆ, p. 252
 - oo. Shrubs, climbing.
DICHAPETALACEÆ, p. 173
 - ll. Anthers not connivent, free from each other.
SCROPHULARIACEÆ, p. 246
 - kk. Ovules solitary in each cell of the ovary, or if 2 then collateral:
 - l. Leaves opposite or verticillate:
 - m. Ovary entire; style terminal.
VERBENACEÆ, p. 240
 - mm. Ovary 4-lobed; style gynobasic.
LABIATÆ, p. 243
 - ll. Leaves alternate.....*POLYGALACEÆ*, p. 172
- dd. Petals absent:
 - e. Hermaphrodite or male, and often the female, flowers without a calyx (perianth) (ee. p. 76):
 - f. Moss-like or hepatic-like aquatic herbs with minute flowers; ovules 2 or more in a 1-celled ovary.....*PODOSTEMONACEÆ*, p. 140
 - ff. Plants not with above habit:
 - g. Leaves stipulate, stipules sometimes adnate to the petiole:
 - h. Ovary 1-celled:
 - i. Herbs or shrubs; leaves usually alternate; flowers in dense spikes.....*PIPERACEÆ*, p. 125
 - ii. Trees or shrubs with alternate leaves; flowers minute on a common receptacle, the fruit becoming immersed in it.
MORACEÆ, p. 128
 - hh. Ovary 2- or more-celled.....*EUPHORBIACEÆ*, p. 173
 - gg. Leaves without stipules:
 - h. Trees or shrubs with hard wood:
 - i. Flowers in a cyathium.....*EUPHORBIACEÆ*, p. 173
 - ii. Flowers not in a cyathium.....*BATIDACEÆ*, p. 133
 - hh. Herbs, sometimes slightly woody at the base:

- i. Ovary 1-celled.....*PIPERACEÆ*, p. 125
- ii. Ovary 2-3-celled.....*EUPHORBIACEÆ*, p. 173
- ee. All the flowers, or at any rate the male, with a calyx, sometimes minute or petaloid and long tubular:
 - f. Moss-like or hepatic-like herbs with minute flowers, aquatic plants.
PODOSTEMONACEÆ, p. 140
 - ff. Plants not as above:
 - g. Leaves opposite or verticillate, never all radical (gg p. 77):
 - h. Leaves stipulate:
 - i. Flowers unisexual:
 - j. Ovary 2- or more-celled....*EUPHORBIACEÆ*, p. 173
 - jj. Ovary 1-celled:
 - k. Ovule erect.....*MORACEÆ*, p. 128
 - kk. Ovule pendulous:
 - l. Filaments not inflexed in the bud.
ULMACEÆ, p. 128
 - ll. Filaments erect or inflexed in the bud.
MORACEÆ, p. 128
 - ii. Flowers hermaphrodite:
 - j. Sepals free or nearly so; stamens hypogynous or perigynous; ovary 1-celled.....*POLYGONACEÆ*, p. 132
 - jj. Sepals connate into a tube; stamens perigynous; ovary 1-5-celled.....*AIZOACEÆ*, p. 134
 - hh. Leaves without stipules:
 - i. Ovules 2 or more in each cell of the ovary or in a 1-celled ovary:
 - j. Flowers hermaphrodite:
 - k. Shrubs or trees:
 - l. Calyx more or less spreading, or not tubular.
CELASTRACEÆ, p. 180
 - ll. Calyx tubular, lobes valvate:
 - m. Ovary 2-4-celled; calyx not or rarely petaloid, often with accessory lobes....*LYTHRACEÆ*, p. 203
 - mm. Ovary 4-celled; calyx petaloid, lobes valvate.
PROTEACEÆ, p. 130
 - kk. Herbs:
 - l. Sepals valvate, often with accessory lobes.
LYTHRACEÆ, p. 203
 - ll. Sepals imbricate, without accessory lobes.
AIZOACEÆ, p. 134
 - i. Flowers unisexual.....*EUPHORBIACEÆ*, 173
 - .. Ovules solitary in each cell of the ovary or in a 1-celled ovary:
 - j. Stamens circinately involute in the bud; calyx usually long-tubular, often colored; bracts sometimes petaloid.
NYCTAGINACEÆ, p. 133

- jj. Stamens sometimes inflexed but not circinate in the bud;
calyx often scarious but rarely petaloid; bracts often
scarious:
- k. Flowers mostly hermaphrodite, not in a cyathium:
 - l. Trees, shrubs or undershrubs with woody stems:
 - m. Stamens numerous. *MONIMIACEÆ*, p. 138
 - mm. Stamens 4. *BATIDACEÆ*, p. 133
 - ll. Herbs, sometimes slightly woody at the base.
AIZOACEÆ, p. 134
- kk. Flowers unisexual, arranged in a cyathium margined
with glands. *EUPHORBIACEÆ*, p. 173
- gg. Leaves alternate or radical or reduced to scales, sometimes
tubiform or pitcher-like:
- h. Leaves stipulate:
 - i. Stamens monadelphous, usually numerous:
 - j. Flowers hermaphrodite. *STERCULIACEÆ*, p. 189
 - jj. Flowers unisexual. *EUPHORBIACEÆ*, p. 173
 - ii. Stamens free or shortly connate at the base:
 - j. Leaves compound:
 - k. Ovary 1-celled, of 1 carpel. *MORACEÆ*, p. 128
 - kk. Ovary 2- or more-celled. *EUPHORBIACEÆ*, p. 173
 - jj. Leaves simple:
 - k. Stipules sheathing and more or less membranous
around the stem. *POLYGONACEÆ*, p. 132
 - kk. Stipules not sheathing:
 - l. Flowers unisexual. *EUPHORBIACEÆ*, p. 173
 - ll. Flowers hermaphrodite. *PHYTOLACCACEÆ*, p. 133
 - hh. Leaves without stipules:
 - i. Stamens the same number as and alternate with the calyx
lobes:
 - j. Herbs. *AIZOACEÆ*, p. 134
 - jj. Trees or shrubs. *BURSERACEÆ*, p. 164
 - ii. Stamens the same number as the calyx lobes and opposite
to them or more numerous or fewer:
 - j. Leaves compound:
 - k. Stamens the same number as and opposite to the calyx-
(perianth) segments; calyx mostly petaloid.
PROTEACEÆ, p. 130
 - kk. Stamens usually more numerous than the calyx lobes;
calyx rarely petaloid:
 - l. Flowers strictly unisexual. *EUPHORBIACEÆ*, p. 173
 - ll. Flowers not strictly unisexual:
 - m. Flowers polygamous-dioecious; wood not resinous:
 - n. Bark bitter. *SIMARUBACEÆ*, p. 164
 - nn. Bark not bitter. *SAPINDACEÆ*, p. 182
 - mm. Flowers not polygamous-dioecious; wood resinous.
ANACARDIACEÆ, p. 178

- jj. Leaves simple:
 - k. Stamens circinate involute in the bud.
 - NYCTAGINACEÆ*, p. 133
 - kk. Stamens sometimes inflexed but not circinate in the bud:
 - l. Stamens more or less connate into a central column:
 - m. Habit various; ovules pendulous.
 - EUPHORBIACEÆ*, p. 173
 - mm. Trees or shrubs; ovule erect.
 - MYRISTICACEÆ*, p. 137
 - ll. Stamens free or the filaments shortly connate only at the base:
 - m. Stamens distinctly perigynous or flowers unisexual; sepals connate into a tube below:
 - n. Herbs or twiners; anthers opening by longitudinal slits:
 - o. Calyx long and tubular. *LYTHRACEÆ*, p. 203
 - oo. Calyx tube short or almost absent:
 - p. Ovary quite superior.
 - CRASSULACEÆ*, p. 141
 - pp. Ovary semisuperior. . . *AIZOACEÆ*, p. 134
 - nn. Trees or shrubs; anthers opening by valves or longitudinal slits:
 - o. Stamens definite:
 - p. Stamens the same number as and opposite the calyx lobes. . . *PROTEACEÆ*, p. 130
 - pp. Stamens more than the primary lobes of the calyx. *LYTHRACEÆ*, p. 203
 - oo. Stamens mostly numerous.
 - MONIMIACEÆ*, p. 138
 - ooo. Stamens usually double the number of the calyx lobes, in 2 or 4 rows.
 - LAURACEÆ*, p. 138
 - mm. Stamens hypogynous or slightly perigynous if accompanied by a disk, or flowers unisexual:
 - n. Trees or shrubs:
 - o. Flowers hermaphrodite. . *OLACACEÆ*, p. 131
 - oo. Flowers unisexual or polygamous:
 - p. Leaves simple or palmately divided.
 - EUPHORBIACEÆ*, p. 173
 - pp. Leaves pinnate or ternately compound.
 - SAPINDACEÆ*, p. 182
 - nn. Herbs. *PHYTOLACCACEÆ*, p. 133
 - cc. Ovary inferior:
 - d. Petals present (dd p. 82):
 - e. Petals free from each other (ee p. 81):
 - f. Leaves opposite or verticillate, never all radical, rarely reduced to scales (ff p. 79):

- g. Leaves compound..... *ARALIACEÆ*, p. 224
- gg. Leaves simple:
 - h. Leaves stipulate..... *RHIZOPHORACEÆ*, p. 204
 - hh. Leaves without stipules:
 - i. Trees, shrubs or climbers:
 - j. Stamens numerous..... *MYRTACEÆ*, p. 206
 - jj. Stamens as many to twice as many as the petals:
 - k. Stamens the same number as and opposite the petals.
LORANTHACEÆ, p. 131
 - kk. Stamens the same number as and alternate with the petals or more numerous:
 - l. Anthers opening by a terminal pore; calyx not valvate..... *MELASTOMACEÆ*, p. 208
 - ll. Anthers opening by longitudinal slits; calyx mostly valvate:
 - m. Ovules 2 or more; trees or woody climbers.
COMBRETACEÆ, p. 205
 - mm. Ovules numerous; herbs or low shrubs.
ONAGRACEÆ, p. 222
 - ii. Herbs, sometimes slightly woody, but then often with fleshy leaves:
 - j. Anthers opening by a terminal pore; leaves mostly with longitudinal parallel nerves.
MELASTOMACEÆ, p. 208
 - jj. Anthers opening by longitudinal slits:
 - k. Flowers in umbels or heads; carpels separating in fruit and suspended by the divided thread-like central axis..... *UMBELLIFERÆ*, p. 224
 - kk. Flowers not in umbels or heads; carpels not separating in fruit:
 - l. Placentas axile with numerous ovules, or ovules very few and pendulous from the apex of the usually 4-celled ovary..... *ONAGRACEÆ*, p. 222
 - ll. Placentas at the bottom of the ovary-cells.
AIZOACEÆ, p. 134
 - ff. Leaves alternate or all radical:
 - g. Flowers unisexual:
 - h. Flowers not in heads or umbels, sometimes paniculate or racemose:
 - i. Leaves without stipules; tendrils often present; anthers often conduplicate or twisted, mostly 3.
CUCURBITACEÆ, p. 267
 - ii. Leaves without stipules or if present then adnate to the petiole, sometimes anisophyllous and then the smaller leaf appearing like a stipule; tendrils present; anthers straight..... *RHIZOPHORACEÆ*, p. 204

- hh. Flowers arranged in heads, umbels or corymbs:
 - i. Fruit of dry, indehiscent mericarps; ovary 2-celled; styles 2; herbs. *UMBELLIFERÆ*, p. 224
 - ii. Characters not as above:
 - j. Leaves usually stipulate; flowers usually umbellate.
ARALIACEÆ, p. 224
 - jj. Leaves without stipules; male flowers corymbose, female solitary *ONAGRACEÆ*, p. 222
- gg. Flowers hermaphrodite:
 - h. Stamens numerous:
 - i. Aquatic herbs with floating leaves; flowers usually large and showy. *NYMPHÆACEÆ*, p. 134
 - ii. Plants not aquatic:
 - j. Leaves gland-dotted; stamens mostly very numerous:
 - k. Fruits not winged. *MYRTACEÆ*, p. 206
 - kk. Fruits broadly winged. *LECYTHIDACEÆ*, p. 203
 - jj. Leaves not gland-dotted:
 - k. Style more or less divided or styles separate; leaves compound *ARALIACEÆ*, p. 224
 - kk. Style simple; leaves simple.
RHIZOPHORACEÆ, p. 204
 - hh. Stamens definite in relation to the sepals and petals, the same number as or about twice as many, rarely fewer:
 - i. Stamens the same number as and opposite the petals.
LORANTHACEÆ, p. 131
 - ii. Stamens the same number as and alternate with the petals or more numerous or fewer:
 - j. Anthers opening by apical pores; leaves with prominent longitudinal parallel nerves. *MELASTOMACEÆ*, p. 208
 - jj. Anthers not opening by pores; leaves usually not as above:
 - k. Leaves stipulate:
 - l. Herbs. *UMBELLIFERÆ*, p. 224
 - ll. Trees or shrubs:
 - m. Leaves compound; stamens as many as the petals.
ARALIACEÆ, p. 224
 - mm. Leaves simple; stamens more than the petals.
ROSACEÆ, p. 141
 - kk. Leaves without stipules:
 - l. Herbs:
 - m. Flowers umbellate. *UMBELLIFERÆ*, p. 224
 - mm. Flowers not umbellate. *ONAGRACEÆ*, p. 222
 - ll. Shrubs or trees:
 - m. Flowers umbellate. *ARALIACEÆ*, p. 224
 - mm. Flowers not umbellate:
 - n. Anthers opening by valves.
HERNANDIACEÆ, p. 140

- nn. Anthers opening by slits:
 - o. Petals contorted *ONAGRACEÆ*, p. 222
 - oo. Petals valvate or imbricate.
 - COMBRETACEÆ*, p. 205
 - ooo. Petals convolute or inflexed.
 - RHIZOPHORACEÆ*, p. 204
- ee. Petals more or less united:
- f. Leaves opposite:
 - g. Leaves stipulate, stipules mostly inter- or intra-petiole.
 - RUBIACEÆ*, p. 254
 - gg. Leaves without stipules:
 - h. Anthers free from each other:
 - i. Stamens double the number of the corolla lobes.
 - LYTHRACEÆ*, p. 203
 - ii. Stamens the same number as the corolla lobes.
 - LORANTHACEÆ*, p. 131
 - hh. Anthers mostly connivent or in pairs around the style:
 - i. Ovule solitary; flowers in heads. . . . *COMPOSITÆ*, p. 269
 - ii. Ovules numerous; flowers usually not in heads.
 - GESNERIACEÆ*, p. 250
 - ff. Leaves alternate or radical:
 - g. Stamens 1-2:
 - h. Flowers hermaphrodite. *GESNERIACEÆ*, p. 250
 - hh. Flowers unisexual. *CUCURBITACEÆ*, p. 267
 - gg. Stamens 3 or more:
 - h. Anthers free from one another or very slightly connate only at the base:
 - i. Stamens the same number as and opposite the corolla lobes:
 - j. Not parasitic; leaves gland-dotted.
 - MYRSINACEÆ*, p. 224
 - jj. Often parasitic; leaves not gland-dotted.
 - LORANTHACEÆ*, p. 131
 - ii. Stamens alternate with the corolla lobes or more numerous or fewer:
 - j. Corolla regular:
 - k. Herbs, often with milky juice.
 - CUCURBITACEÆ*, p. 267
 - kk. Woody, rarely subherbaceous, not with milky juice:
 - l. Stamens free from the corolla:
 - m. Stipules present, often adnate to the petiole.
 - ARALIACEÆ*, p. 224
 - mm. Stipules absent. *LECYTHIDACEÆ*, p. 203
 - ll. Stamens epipetalous. *SYMPLOCACEÆ*, p. 227
 - jj. Corolla irregular. *LOBELIACEÆ*, p. 269
 - hh. Anthers more or less united into a ring around the style:
 - i. Flowers not in heads surrounded by a common involucre:

- j. Flowers hermaphrodite, irregular; tendrils absent.
LOBELIACEÆ, p. 269
- jj. Flowers unisexual, regular; tendrils usually present.
CUCURBITACEÆ, p. 267
- ii. Flowers in heads surrounded by a common involucre.
COMPOSITÆ, p. 269
- dd. Petals absent:
 - e. Leaves stipulate:
 - f. Flowers unisexual. *MORACEÆ*, p. 128
 - ff. Flowers hermaphrodite. *RHIZOPHORACEÆ*, p. 204
 - ee. Leaves without stipules, but sometimes when opposite connate and sheathing at the base:
 - f. Ovules numerous on axile placentas. *ONAGRACEÆ*, p. 222
 - ff. Ovules solitary or few, inserted at the top or base of the ovary:
 - g. Ovules pendulous from the apex of the ovary or at the apex of a basal placenta, usually more than 1:
 - h. Trees, shrubs or woody climbers; sepals mostly valvate:
 - i. Anthers opening by valves:
 - j. Calyx lobes imbricate. *LAURACEÆ*, p. 138
 - jj. Calyx lobes valvate. *HERNANDIACEÆ*, p. 140
 - ii. Anthers opening by longitudinal slits.
COMBRETACEÆ, p. 205
 - hh. Herbs; sepals mostly imbricate. *AIZOACEÆ*, p. 134
 - gg. Ovule 1, erect. *LORANTHACEÆ*, p. 131

ANNOTATED CATALOGUE OF THE SPECIES

Division PTERIDOPHYTA. Ferns and Fern Allies

1. HYMENOPHYLLACEÆ. Filmy Fern Family

1. HYMENOPHYLLUM J. E. Smith

1. *Hymenophyllum polyanthos* Swartz, in Schrader, *Journal für die Botanik* 1800²: 102. 1801.

A small, flaccid, creeping, bright olive-green fern; fronds delicately membranous, 3-4-pinnatifid, 5-20 cm. long.

A very variable fern with an extensive and difficult synonymy. It occurs most frequently on tree ferns, tree trunks, and damp rocks.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1960.

Range: Widely distributed in continental America from Mexico southward and in tropical and subtropical portions of the old world.

2. CYATHEACEÆ. Tree Fern Family

| | |
|--------------------------------|---------------------|
| Indusia present, inferior..... | 1. <i>HEMITELIA</i> |
| Indusia wanting..... | 2. <i>ALSOPHILA</i> |

1. *HEMITELIA* R. BROWN

| | |
|--------------------------|-------------------------|
| Indusia ciliate..... | 1. <i>H. Parkeri</i> |
| Indusia not ciliate..... | 2. <i>H. multiflora</i> |

1. *Hemitelia Parkeri* Hooker, Species Filicum 1: 32. 1844.

Hemitelia guianensis var. *Parkeri* Hooker and Baker, Synopsis Filicum 30. 1868.

Hemitelia multiflora var. *Parkeri* Christensen, Index Filicum 350. 1905.

A robust tree-like fern with hair-like scales providing a fairly dense pubescence, especially on the rachises; fronds leathery, up to 2 m. long, 2-3-pinnate-pinnatifid except at the apex.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1902.

Range: Equatorial America.

2. *Hemitelia multiflora* (J. E. Smith) R. Brown, Prodrum Floræ Novæ-Hollandiæ et Insulæ Van Diemen 158. 1810.

Cyathea multiflora J. E. Smith, Mémoires, Reale Academia delle Scienze, Turin 5: 416. 1793.

A nearly glabrous tree-like fern similar to the preceding but with the hair-like scales few and scattered, mostly on the pinnæ; fronds up to 2 m. long, 2-3-pinnate-pinnatifid except at the apex.

Vicinity of Kartabo, July 27, 1924, *Graham* 363.

Range: South American tropics.

2. *ALSOPHILA* R. BROWN

Fronds 1-pinnate; pinnæ 15-30 cm. long; rachis glabrous.....1. *A. blechnoides*

Fronds 2-pinnate; pinnæ 30-40 cm. long; rachis thorny.....2. *A. microdonta*

1. *Alsophila blechnoides* (L. C. Richard) Hooker, Species Filicum 1: 35. 1844.

Polypodium blechnoides L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 114. 1792.

A slender fern; fronds 1-pinnate, up to 2 m. long; pinnæ oblong-lanceolate, serrate, suddenly acuminate at the apex; sori mixed with hairs and in a single row on each side of the midrib.

Vicinity of Kartabo, July 21, 1924, *Graham 311*.

Range: West Indies and tropical America.

2. ***Alsophila microdonta*** Desvaux, Prodrôme de la famille des Fougères 319. 1827.

A large robust fern; fronds 2-pinnate, more than 3 m. long with stiff scattered spines; pinnae 40 cm. long, 20 cm. broad; pinnules deeply divided, nearly sessile, 6-10 cm. long, 1.5-2.5 cm. broad.

Graham 386 was collected in a moist depression in the jungle. Along Camaria road, Cuyuni River, July 30, 1924, *Graham 386*.

Range: American tropics.

3. POLYPODIACEÆ. Fern Family

- a. Indusia absent (Exinvolucratæ):

- b. Sporangia scattered in strata over the under surface of the fronds.

1. *ELAPHOGLOSSUM*

- bb. Sporangia in circular or linear sori:

- c. Sori not more than twice as long as broad, round to elliptic.

2. *POLYPODIUM*

- cc. Sori more than twice as long as broad, linear. . . . 3. *PITYROGRAMMA*

- aa. Indusia present (Involucratæ):

- b. Sori at the edge of the frond or segment, the reflexed margin forming the indusium:

- c. Sori clearly distinct. 4. *ADIANTUM*

- cc. Sori forming a continuous line underneath the margin:

- d. Indusia opening outwardly. 5. *LINDSAYA*

- dd. Indusia opening inwardly. 6. *PTERIDIUM*

- bb. Sori variously placed on the back of the frond, not on the edge with marginal reflexed indusium:

- c. Shape of sori linear or oblong, twice as long, or more than twice as long as broad:

- d. Position of sori parallel to the midrib. 7. *BLECHNUM*

- dd. Position of sori oblique or transverse to the midrib. . 8. *ASPENIUM*

- cc. Shape of sori circular, or less than twice as long as broad:

- d. Indusia spread over the sori, covering them, usually not on the margins of the fronds:

- e. Indusia cordate-reniform, attached by the sinuses. 9. *DRYOPTERIS*

- ee. Indusia orbicular, fixed by the center. 10. *CYCLODIUM*

- dd. Indusia not spread over the sori, often on the margins of the fronds.

11. *NEPHROLEPIS*

1. ELAPHOGLOSSUM Schott

1. **Elaphoglossum glabellum** J. Smith, London Journal of Botany 1: 197. 1842.

Acrostichum martinicense Fée, Mémoires sur la famille des Fougères 2: 45. 1845, in part; not Desvaux 1811.

An epiphytic fern; fronds entire, 30-45 cm. long, 5-15 mm. broad, often involute and tapering into a woody stipe 3 cm. or more in length.

Graham 124 was found growing in a mossy hummock in the crotch of a jungle tree 13 m. from the ground.

Vicinity of Kartabo, June 28, 1924, *Graham 124*.

Range: American tropics.

2. POLYPODIUM Linnæus

Fronds dimorphous, sterile ones 2-8 cm. long, 1-2 cm. broad. 1. *P. ciliatum*

Fronds not dimorphous, all more than 8 cm. long:

Sori uniserial. 2. *P. percussum*

Sori not uniserial. 3. *P. phyllitides*

1. **Polypodium ciliatum** Willdenow, Species plantarum 5: 144. 1810.

Polypodium piloselloides var. *ciliatum* Hooker and Baker, Synopsis Filicum 340. 1868.

A small, climbing epiphytic fern; fronds entire, ovate to elliptic-lanceolate, punctate, ciliate especially on the margins, the fertile ones so narrow that the sori project beyond their edges; rhizomes brown-ciliate like the short stipes of the fronds.

Along Camaria road, Cuyuni River, climbing on dead stump, July 31, 1924, *Graham 400*.

Range: Common throughout tropical America.

2. **Polypodium percussum** Cavanilles, Descripcion de las Plantas 243. 1802.

Lepicystis percussa Diels, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 1⁴: 323. 1899.

An epiphytic fern; fronds hard, leathery, entire, linear-lanceolate, 15-30 cm. long, narrowed into the stipe; sori large, circular, forming prominent depressions in the upper side of the frond in a single row between the midrib and the edge.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50'$ N., July 15-19, 1922, *De La Cruz 1654*; Malali, Demerara River, Lat. about $5^{\circ} 35'$ N., October 30-November 5, 1922, *De La Cruz 2609*.
Range: Costa Rica to Peru and Brazil.

3. **Polypodium phyllitides** Linnæus, Species Plantarum 1083. 1753.

Campylonerum phyllitides Presl, Tentamen Pteridographiæ 190. pl. 7, f. 18-20. 1836.

A robust fern; fronds bright green, entire, lanceolate, 3-80 cm. long, 2.5-10 cm. broad, with prominent straw-colored midribs.

Graham 346 was found growing on the rocks of the river bank. Matope Falls, Cuyuni River, July 24, 1924, *Graham 346*.

Range: Common from Florida through the Bahamas and West Indies southward to Brazil.

3. PITYROGRAMMA Link

1. **Pityrogramma calomelanos** (Linnæus) Link, Handbuch . . . Gewächse 3: 20. 1833. SILVER FERN

Acrostichum calomelanos Linnæus, Species Plantarum 1072. 1753.

Gymnogramma calomelanos Kaulfuss, Enumeratio Filicum 76. 1824.

Ceropteris calomelana Link, Filicum species in horto regio botanico berolinensis cultæ 141. 1841.

Neurogramma calomelanos Diels, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 14: 264. 1899.

An erect fern; fronds 2-pinnate, about 6 dm. long; pinnules lance-elliptic, distant, deeply serrate, conspicuously coated beneath with a white powder; rachis shiny, dark brown, stipe nearly as long as the blade.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25'$ N., September 3-12, 1922, *De La Cruz 1989*; Malali, Demerara River, Lat. about $5^{\circ} 35'$ N., October 30-November 5, 1922, *De La Cruz 2674*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3013*.

Range: American tropics, west Africa and Natal.

4. ADIANTUM Linnæus

- Pinnules acuminate at the apex. 1. *A. latifolium*
Pinnules broadly obtuse at the apex. 2. *A. triangulatum*

1. **Adiantum latifolium** Lamarck, Encyclopédie Méthodique, Botanique 1: 43. 1783.

A small erect fern; fronds broadly triangular, 30-95 cm. long, 2-pinnate; rachis shiny, black, tomentose especially toward the tip.

In swamp, along Camaria road, Cuyuni River, July 30, 1924, *Graham 385*.

Range: American tropics.

2. **Adiantum triangulatum** Kaulfuss, Enumeratio Filicum 204. 1824.

A small erect fern; fronds narrowly triangular, 30-95 cm. long, 2-pinnate; rachis scurfy-tomentose.

This species differs from the preceding largely in the obtuse pinnules and in the more tomentose rachis. *Graham 312* was collected along a rocky creek tributary to the Mazaruni River.

Vicinity of Kartabo, July 21, 1924, *Graham 312*.

Range: Guianas, Ecuador, and the Amazon valley.

5. LINDSAYA Dryander

Fronds 1-pinnate, ultimate segments rhombic-trapeziform. 1. *L. falcata*
Fronds 2-pinnate, ultimate segments deltoid. 2. *L. guianensis*

1. **Lindsaya falcata** Dryander, Transactions of the Linnæan Society 3: 41. 1797.

A pea-green colored fern; fronds 15-40 cm. long; pinnae large, entire, rhombic to trapeziform; rachis dark brown, glabrous.

Graham 261a was found in dense jungle along the shore of the Mazaruni River growing with *Graham 261b*, *Lindsaya guianensis*.

Vicinity of Kartabo, July 14, 1924, *Graham 261a*.

Range: American tropics.

2. **Lindsaya guianensis** (Aublet) Dryander, Transactions of the Linnæan Society 3: 42. 1797.

Adiantum guianense Aublet, Histoire des Plantes de la Guiane Française 2: 963. 1775.

A light green fern; fronds 30-60 cm. long, 2-pinnate; pinnules deltoid; rachis black.

Graham 261b was found in dense jungle along the shore of the Mazaruni River growing with *Graham 261a*, *Lindsaya falcata*.

Vicinity of Kartabo, July 14, 1924, *Graham 261b*.

Range: American tropics.

6. PTERIDIUM Scopoli

1. **Pteridium caudatum** (Linnæus) Maxon, Proceedings of the U. S. National Museum 23: 631. 1901. SOUTHERN BRACKEN

Pteris caudata Linnæus, Species Plantarum 1075. 1753.

Pteris aquilina var. *caudata* Hooker, Species Filicum 2: 196. 1858.

A coarse fern usually less than 1 m. high but in some habitats reaching a height of several meters; fronds 2-4-pinnate, the ultimate segments narrow and remote from one another, margins revolute, often strongly so; rachis wiry, glabrous.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2658.

Range: Florida and the Bahamas through the West Indies and tropical continental America.

7. BLECHNUM Linnæus

1. **Blechnum serrulatum** L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 114. 1792.

Blechnum indicum Burman, Flora Indica 231. 1768.

An erect fern; fronds 1-pinnate, 9 dm. long, 1-2 dm. broad; pinnæ finely serrate on the margins; sporangia densely arranged close to and on either side of the midrib, occupying one-third to one-half the width of the pinna.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1924.

Range: Tropical America, Asia, Australia and New Caledonia.

8. ASPLENIUM Linnæus

1. **Asplenium serratum** Linnæus, Species Plantarum 1079. 1753.

A stout epiphytic fern; fronds entire, lanceolate, 8 dm. long, 5-8 cm. broad or broader, acuminate at the apex, attenuate at the base where the midrib becomes very conspicuous; sori parallel with the veins and extending two-thirds of the distance from the midrib to the margin of the frond.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1876.

Range: American tropics and the Congo.

9. DRYOPTERIS Adanson

Fronds 2-pinnate, broadly triangular. 1. *D. protensa* var. *funesta*

Fronds 1-pinnate, not broadly triangular:

Pinnæ more than 20 cm. long. 2. *D. extensa*

Pinnæ less than 20 cm. long:

Fronds more than 1 m. high. 3. *D. serrata*

Fronds less than 1 m. high:

Pinnæ more than 1 cm. broad. 4. *D. pyramidata*

Pinnæ less than 1 cm. broad. 5. *D. gongylodes*

1. **Dryopteris protensa** var. **funesta** (G. Kunze) C. Christensen, Index Filicum 286. 1905.

Aspidium funestum G. Kunze, Linnæa 9: 96. 1834.

An erect fern; fronds broadly triangular, 5-20 dm. long, 2-5 dm. broad, 2-3-pinnate-pinnatifid; sori small, scattered on the veins; rachis slightly brown tomentose.

Graham 313 was collected along a rocky creek and was nearly 2 m. high.

Vicinity of Kartabo, July 21, 1924, *Graham 313*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1892*.

Range: Tropical America.

2. **Dryopteris extensa** (C. L. Blume) O. Kuntze, Revisio Generum Plantarum 2: 812. 1891.

Aspidium extensum C. L. Blume, Enumeratio Plantarum Javæ et Insularum adjacentium 156. 1828.

A nearly glabrous erect fern; fronds 1 m. long or longer; pinnæ long, narrow, cut nearly three-fourths of the way to the midrib into slightly sickle-shaped lobes.

Graham 383 was found at a clearing's edge and was 2 m. high. Along Camaria road, Cuyuni River, July 30, 1924, *Graham 383*.

Range: Introduced from Asia; throughout the tropics (?).

3. **Dryopteris serrata** (Cavanilles) C. Christensen, Index Filicum 291. 1905.

Meniscium serratum Cavanilles, Descripcion de las Plantas 548. 1803.

Nephrodium serratum Keyserling, Polypodiacea Cyatheacea Herbarii Bungeani 49. 1873.

An erect glabrous fern; fronds 1-pinnate, 2-3 m. long; pinnæ 15-30 cm. long, narrowed gradually from the base to the apex, irregularly serrate.

Graham 379 was found in a swamp and was 3 m. high.

Along Camaria road, Cuyuni River, July 30, 1924, *Graham* 379.

Range: American tropics.

4. ***Dryopteris pyramidata*** (Fée) Maxon, Contributions from the U. S. National Herbarium 10: 489. 1908.

Goniopteris pyramidata Fée, Histoire des Fougères et des Lycopodiacees des Antilles, mém. II. 61. 1866.

A small erect fern; fronds 1-pinnate, 30-60 cm. long, 10-20 cm. broad; pinnae crenately toothed; rachis slightly tomentose.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 389.

Range: Florida to Brazil and Peru.

5. ***Dryopteris gongylodes*** (Schkuhr) O. Kuntze, Revisio Generum Plantarum 2: 811. 1891.

Aspidium gongylodes Schkuhr, Kryptogamische Gewächse 1: 193, pl. 33c. 1809.

A small erect fern; fronds leathery, 1-pinnate, 5 dm. or more long, generally less than 12 cm. broad; pinnae less than 1 cm. broad, cut into rounded lobes which extend one-third to one-half way to the midrib.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2437.

Range: Florida and the West Indies to Brazil and Peru, tropics and subtropics of Africa, Asia, East Indies, Australia and Polynesia.

10. CYCLODIUM Presl

1. ***Cyclodium meniscioides*** (Willdenow) Presl, Tentamen Pteridographiae 85. 1836.

Aspidium meniscioides Willdenow, Species Plantarum 5: 218. 1810.

A slender fern; fronds 1-pinnate, up to 1 m. long; fertile pinnae entire, distant, 7-12 cm. long, the barren ones much larger; rachis straw-colored, striated.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1921.

Range: West Indies to Brazil and Peru.

11. NEPHROLEPIS Schott

Pinnae sessile, 2.5-6 cm. long, acutely short-auriculate on the upper side at the base, convex-cuneate below, with minutely small scales beneath... 1. *N. rivularis*

Pinnae not sessile, 8-20 cm. long, usually roundish-truncate or broadly cuneate at the base, with minutely long, distinct hairs beneath..... 2. *N. biserrata*

1. **Nephrolepis rivularis** (Vahl) Mettenius, in Krug, Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie **24**: 122. 1897.

Polypodium rivulare Vahl, Eclogæ Americanæ **3**: 51. 1807.

An erect fern; fronds 1-pinnate, 6-12 dm. long, 1-2 dm. broad; pinnae 4-6 cm. long, 1-1.5 cm. broad, serrate on the margins; sori in a single row near the edge of the frond.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1656; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2994.

Range: American tropics.

2. **Nephrolepis biserrata** (Swartz) Schott, Genera Filicum under pl. 3. 1834.

Aspidium biserrata Swartz, in Schrader, Journal für die Botanik **1800**²: 32. 1801.

An erect fern; fronds 1-pinnate, 1-5 m. long, 1-4 dm. broad; pinnae 8-20 cm. long, 1.2-2.5 cm. broad, margins serrulate to crenate; sori in a single row near the edge of the frond.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1893.

Range: Throughout the tropics.

Acrostichum aureum Linnæus, the Giant Swamp Fern, which ranges throughout the tropics, is reported by British Empire Exhibition (1924) and by Posthumus (1928) along the coast in open tracts. It may as well occur along the rivers near Kartabo. It is a coarse, leathery fern with fronds up to 3 m. long, simply pinnate with ligulate pinnae about 20 cm. long, the sori without indusia.

4. SCHIZÆACEÆ. Climbing Fern Family

1. LYGODIUM Swartz

1. **Lygodium micans** J. W. Sturm, in Martius, Flora Brasiliensis **1**²: 178. 1859.

A climbing fern characterized by scandent, twining stems; pinnule segments ligulate-oblong, 7-20 cm. long, 1.5-3 cm. broad, distinctly stalked at the base; sori-bearing spikes along the margins of the leafy segments.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1984*; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz 2611*.

Range: West Indies to Brazil.

5. SALVINIACEÆ. Salvinia Family

1. SALVINIA Linnæus

1. **Salvinia auriculata** Aublet, Histoire des Plantes de la Guiane Françoise 2: 969. 1775.

Salvinia rotundifolia Willdenow, Species Plantarum 5: 537. 1810.

Salvinia hispida, Humbolt, Bonpland, and Kunth, Nova Genera et Species Plantarum 1: 44. 1815.

A small floating fern; fronds more or less two-lobed, circular, 1.5 cm. in diameter, the upper surfaces bearing acute papillæ that are longest in the center of the frond.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2984*.

Range: Tropical America.

Azolla caroliniana Willdenow, according to British Empire Exhibition (1924), occurs in the lakes at Georgetown. It is a minutely frondose, free-floating moss-like plant which is widely distributed in continental America and may well exist nearer Kartabo.

6. EQUISETACEÆ. Horsetail Family

Equisetum sp. has been reported at Kartabo by Beebe (1925) who writes that "here and there are small patches of Horsetails, *Equisetum*, hinting of epochs long past. In 1919 these were confined to an area of not more than two square yards. Two years later this particular section had been washed away and I have found no further trace of these plants."

7. LYCOPODIACEÆ. Club Moss Family

1. LYCOPODIUM Linnæus

1. **Lycopodium cernuum** Linnæus, Species Plantarum 1103. 1753.

A semi-crawling bushy club moss; leaves linear, acuminate, spreading, incurved, 2 mm. long; cones terminal on the branches, 1 cm. long or less, cernuous or nodding.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 119*; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2664*; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1607*.

Range: Tropics generally, extending to the Azores, St. Helena, St. Paul, New Zealand and the Cape of Good Hope.

8. SELAGINELLACEÆ. Selaginella Family

I. SELAGINELLA Beauvois

Stems decumbent, at least the main stems, root fibers extending to their upper nodes:

- Plants with articulated stems.....1. *S. affinis*
- Plants without articulated stems.....2. *S. producta*

Stems erect, simple in the lower part, decompound and frond-like upwards, root fibers confined to the base.....3. *S. Parkeri*

1. **Selaginella affinis** A. Braun, in Triana et Planchon, Annales des Sciences Naturelles V. 3: 296. 1865.

Selaginella Poeppigiana var. *guyanensis* Spring, Monographie de la Famille des Lycopodiacees 218. 1848.

A trailing plant; stems 30 cm. long or more, flat on the back and two-grooved above; branches about 1 cm. broad; cones 5-15 mm. long, with strongly keeled bracts.

Graham 368 was found prostrate on the ground beside a jungle stream.

Vicinity of Kartabo, July 28, 1924, *Graham 368*.

Range: Guianas.

2. **Selaginella producta** Baker, Journal of Botany 243. 1883.

A small trailing plant; stems 15-30 cm. long, trailing in the lower half, flat or rounded on the back and two-grooved above, the ends and branches ascending; cones 1.5-2.5 cm. long, 1-2 mm. broad.

Graham 315 was found on the ground along a rocky creek in the jungle, *Graham 407* in dense mats on the ground at the edge of a clearing.

Vicinity of Kartabo, July 21, 1924, *Graham 315*; along Camaria road, Cuyuni River, July 31, 1924, *Graham 407*.

Range: Guianas and the Amazon valley.

3. **Selaginella Parkeri** (Hooker and Greville) Spring, *Monographie de la Famille des Lycopodiacees* 226. 1848.

Lycopodium Parkeri Hooker and Greville, *Enumeratio Filicum*, in Hooker, *Botanical Miscellany* 2: 388. 1831.

An erect plant; stems 30-40 cm. long, simple in the lower half or two-thirds and several times divided above; cones 3-5 mm. long, half as broad.

Graham 314 was found trailing over rocks beside a jungle stream. Vicinity of Kartabo, July 21, 1924, *Graham* 314.

Range: Guianas and the Amazon valley.

Selaginella spp.. The following unidentified specimens from the Kartabo region are in the Herbarium: Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1593; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1606; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1608; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1609; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1935; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2679.

Division SPERMATOPHYTA. Seed Plants or Flowering Plants

Class MONOCOTYLEDONEÆ. Monocotyledons

9. TYPHACEÆ. Cattail Family

Typha domingensis Persoon, the Bullrush or Cattail, is reported by British Empire Exhibition (1924) to occur in open cultivated tracts along the coast. It may easily occur along the rivers nearer Kartabo as well. This is a narrow leaved species and is considered by some authors to be synonymous with the northern *Typha angustifolia* Linnaeus.

10. POTAMOGETONACEÆ. Pondweed Family

On the rocks in the swiftly running water above a falls an unidentified specimen belonging to this family was collected at Matope, Cuyuni River, July 24, 1924, *Graham* 349.

II. GRAMINEÆ. Grass Family

- a. Plants woody, arborescent.....1. *BAMBUSA*
- aa. Plants herbaceous, grass-like:
 - b. Glumes hard; fertile lemma and palea hyaline or membranous, the sterile lemma like the fertile one in texture:
 - c. Inflorescence not monœcious, the fertile spikelets perfect, each usually paired with a sterile spikelet:
 - d. Spikelets all perfect.....2. *IMPERATA*
 - dd. Spikelets not all perfect, the sessile usually perfect, the pedicellate usually staminate or rudimentary.....3. *ANDROPOGON*
 - cc. Inflorescence monœcious, the pistillate spikelets below, the staminate above on the same rachis.....4. *COIX*
 - bb. Glumes membranous; fertile lemma and palea hard or at least as firm as the glumes; sterile lemma like the glumes in texture:
 - c. Spikelets unisexual; plants monœcious.....5. *OLYRA*
 - cc. Spikelets perfect:
 - d. Fruits cartilaginous, not rigid, the margins of the lemma flat, not inrolled; inflorescence of digitate or flabellately paniced slender racemes.....6. *SYNTHESISMA*
 - dd. Fruits hard, rigid:
 - e. First glume wanting, rarely present in part of the spikelets; spikelets plano-convex, in dense, 1-sided, spikelike racemes.
7. *PASPALUM*
 - ee. First glume present; spikelets biconvex.....8. *PANICUM*

1. *BAMBUSA* Schreber

1. *Bambusa vulgaris* Schrader, in Wendland, *Collectio Plantarum* 2: 26. pl. 47. 1808. COMMON BAMBOO

This is the well known oriental bamboo, several magnificent clumps of which thrive about the Kartabo laboratory, reaching a height of nearly 15 m. Although introduced and frequently cultivated, Hitchcock (1922) believes that it may be spontaneous as well.

Vicinity of Kartabo, July 18, 1924, *Graham* 277.

Range: Native country doubtful but now widely cultivated throughout the tropics of both hemispheres.

2. *IMPERATA* Cyrillo

1. *Imperata contracta* (Humbolt, Bonpland, and Kunth) Hitchcock, Report of the Missouri Botanical Garden 4: 146. 1893.

Saccharum contractum Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 1: 182. 1816.

An erect tufted perennial 1 m. high or more; leaves flat, narrow, mostly clustered toward the base; panicle pale, silky, narrow, sometimes 40 cm. long.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3036.

Range: Mexico and the West Indies to northern South America.

3. ANDROPOGON Linnæus

1. **Andropogon bicornis** Linnæus, Species Plantarum 1046. 1753.

BEARD GRASS

A tall, conspicuous, tufted perennial of open ground; leaves linear, scabrous on the margins; inflorescence large, feathery, of delicate racemes.

Graham 117 was found in a clearing and was 1.5 m. tall with shallow roots.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 117*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3037.

Range: Mexico and the West Indies to Brazil.

4. COIX Linnæus

1. **Coix lacryma-jobi** Linnæus, Species Plantarum 972. 1753.

JOB'S TEARS

A freely branching perennial about 1 m. high; leaves broad, cordate, clasping, 2-3 cm. broad; fruit pearl or drab colored, 8-10 mm. long.

It is sometimes cultivated for the hard, bead-like fruits which are used for ornament.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3064.

Range: East Indies and tropical America.

5. OLYRA Linnæus

1. **Olyra latifolia** Linnæus, Systema Naturæ ed. 10, 2: 1261. 1759.

Olyra arundinacea Humbolt, Bonpland, and Kunth, Nova Genera et Species Plantarum 1: 197. 1816.

A bamboo-like perennial often 5 m. high; stems hollow, sometimes 1 cm. thick, the long internodes blotched with purple; leaves broadly ovate, about 15 cm. long, 6 cm. broad; panicles 10-15 cm. long, two-thirds as broad.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2613; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2919; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2655.

Range: Northern Mexico and the West Indies throughout tropical America, and in the African tropics.

6. SYNTERISMA Walters

1. **Syntherisma sanguinalis** (Linnæus) J. Dulac, Flore des Hautes-Pyrénées 77. 1867. CRAB GRASS

Panicum sanguinale Linnæus, Species Plantarum 57. 1753.

Digitaria sanguinalis J. A. Scopoli, Flora Carniolica ed. 2. 1: 52. 1772.

A decumbent, branching weedy grass; leaves flat, linear, sheaths pilose; racemes 5-10, in 1 or 2 whorls.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 228a.

Range: Temperate and tropical regions of both hemispheres; widely distributed as a weed.

7. PASPALUM Linnæus

1. **Paspalum virgatum** Linnæus, Systema Naturæ ed. 10. 2: 855. 1759.

A robust perennial about 2 m. high, growing in large clumps; leaves broadly linear, 50 cm. long, 1-2 cm. broad, margins very scabrous; panicles loose, 20-40 cm. long.

Matope, Cuyuni River, July 23, 1924, *Graham* 337.

Range: Mexico and the West Indies to Argentine.

8. PANICUM Linnæus

Spikelets short-pedicel along one side of the panicle branches, forming more or less spike-like racemes..... 1. *P. pilosum*

Spikelets in open or contracted panicles, but not in 1-sided spike-like racemes.

2 *P. zizanioides*

1. **Panicum pilosum** Swartz, Prodrromus Descriptionum Vegetabilium Indiæ Occidentalis 22. 1788.

Panicum distichum Lamarck, Encyclopédie Méthodique, Botanique 4: 741. 1796.

Panicum pilisparsum Meyer, Primitiæ Floræ Essequiboensis 57. 1818.

A spreading or ascending perennial; leaves ovate-lanceolate, 10-15 cm. long; panicles 5-15 cm. long, the spikelets arranged more or less

distinctly on one side of numerous, dense racemes 1-3 cm. or more in length, rather loosely arranged along the main axis.

In second growth jungle, Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 100*.

Range: Mexico and the West Indies to Brazil and Paraguay.

2. ***Panicum zizanioides*** Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 1: 100. 1816.

Panicum oryzoides Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 23. 1788; not *P. oryzoides* Arduino 1764.

A perennial 30-60 cm. high, growing in dense tangles; leaves ovate-linear, cordate-clasping, 5-15 cm. long, about 1-2 cm. broad; panicle of a few ascending, distant branches.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 229*; Matope, Cuyuni River, July 23, 1924, *Graham 339*.

Range: Throughout the tropics.

Zea Mays Linnæus, the Indian Corn, was observed by the writer in Georgetown where it was cultivated and also grown in yards as an ornamental part of a formal garden design, and ***Saccharum officinarum*** Linnæus, the Sugar Cane, is one of the colony's chief crops.

12. CYPERACEÆ. Sedge Family

- a. Flowers of the spikelets, or at least one of them, perfect:
 - b. Spikelets perfect or mainly so, rarely of two scales and one flower, or if polygamous, plants with leaves not densely imbricated on the stems (*Kyllinga*):
 - c. Scales of spikelets 2-ranked:
 - d. Spikelets with 2-several perfect flowers, scales several-many.
 1. *CYPERUS*
 - dd. Spikelets with 1 perfect flower, scales 2-4.....2. *KYLLINGA*
 - cc. Scales of spikelets spirally imbricated all around:
 - d. Base of style not at all or only slightly thickened, deciduous:
 - e. Fertile glumes including 3 scales below the flower (rarely abortive).
 3. *FUIRENA*
 - ee. Fertile glumes including 4 scales below the flower, lower empty.
 4. *DIPLASIA*
 - dd. Base of style manifestly swollen, persistent as a tubercle on the achene, or deciduous:
 - e. Perianth present.....5. *ELEOCHARIS*
 - ee. Perianth wanting:
 - f. Achene not surmounted by a tubercle.....6. *FIMBRISTYLIS*
 - ff. Achene surmounted by a tubercle.....7. *DICHROMENA*

- bb. Spikelets polygamous, or rarely of 4 scales and only 1 flower:
 - c. Spikelets many flowered.....8. *HYPOLYTRUM*
 - cc. Spikelets few-flowered, usually 1-2, rarely 3-6.....9. *RYNCHOSPORA*
- aa. Flowers monœcious or diœcious.....10. *SCLERIA*

1. CYPERUS Linnæus

- Spikelets flattened, less than 1 cm. long.....1. *C. diffusus*
- Spikelets not flattened, 1-2 cm. long.....2. *C. ligularis*

1. *Cyperus diffusus* Vahl, Enumeratio Plantarum 2: 321. 1806.

Cyperus laxus Grisebach, Flora of the British West Indian Islands 563. 1864;
not *C. laxus* Lamarck 1791.

A tufted sedge, 30-60 cm. high; culm naked; leaves linear, 3-6 mm. broad from the base, almost as long as the stem; spikes small and delicate, bracts 4-10, 3-6 dm. long.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 230.

Range: Throughout the tropics.

2. *Cyperus ligularis* Linnæus, Amoenitates Academicæ 5: 391. 1759; Systema Naturæ ed. 10. 2: 867. 1759.

Mariscus rufus Humbolt, Bonpland, and Kunth, Nova Genera et Species
Plantarum 1: 216. 1816.

Mariscus ligularis Urban, Symbolæ Antillanæ 2: 165. 1900.

A rather robust sedge, 3-10 dm. high; leaves linear, about three-fourths as long as the stem, 5-10 mm. broad; spikes thick and heavy; bracts 4-7, 3-6 dm. long; achene ellipsoid, 3-angled, dark brown; 1.5 mm. long.

Graham 135 was found on a sand clearing at the top of a low hill.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 135.

Range: Generally distributed from Florida and the Bahamas through the West Indies and continental tropical America to Brazil; also in the old world tropics.

Cyperus articulatus Linnæus, the Bizzy-bizzy, a sedge of cosmopolitan distribution in the tropics, is reported by British Empire Exhibition (1924) in swamps along the coast. It is a stout sedge up to 2 m. high; the basal leaves reduced to scarious bladeless sheaths, those of the involucre 3, triangular to linear, shorter than the inflorescence; the spikelets narrow, 1-5 cm. long; the achene 3-angled, nearly black.

2. KYLLINGA Rottbøell

1. **Kyllinga pumila** Michaux, Flora Boreali-Americana 1: 28. 1803.

A tufted annual 5-25 cm. high; leaves linear, about two-thirds as long as the culms; heads 1-3, 5-9 mm. long, with 3-4 bracts greatly exceeding them.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 228.
Matope, Cuyuni River, July 23, 1924, *Graham* 334.

Range: Common in African and American tropics; also in temperate America and in Pennsylvania north to Presque Isle, Erie County.

3. FUIRENA Rottbøell

1. **Fuirena umbellata** Rottbøell, Descriptionum et Iconum Rariores et pro maxima Parte Novas Plantas 70. pl. 19. 1773.

Fuirena paniculata Linnæus filius, Supplementum Plantarum 105. 1781.

Fuirena camptotricha C. Wright, in Sauvalle, Anales del Academia de Ciencias Medicas, Fisicas y Naturales de la Habana 8: 177. 1871.

A coarse plant 5-15 dm. high with a 3-angled stem; leaves ligulate-linear, 15 cm. long, 8-12 mm. broad; spikes in dense compound clusters subtended by a large leaf-like bract.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3042; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3062.

Range: Throughout the tropics and subtropics of both hemispheres.

4. DIPLASIA L. C. Richard

1. **Diplasia karatæfolia** L. C. Richard, in Persoon, Synopsis Plantarum seu Enchiridium Botanicum 1: 70. 1805.

A robust sedge, 5-8 dm. high; leaves lanceolate, up to 10 dm. long, 5 cm. broad, scabrous on the margin; lower bracts 2-4 dm. long; spikes up to 3 cm. long, 3 mm. in diameter.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2945.

Range: Guianas and the Amazon valley.

5. ELEOCHARIS R. BROWN

1. **Eleocharis geniculata** (Linnæus) Roemer and Schultes, Systema Vegetabilium 2: 150. 1817; not *E. geniculata* R. Brown 1810.

SPIKERUSH

Scirpus geniculatus Linnæus, Species Plantarum 48. 1753.

A straight rush-like plant 3-8 dm. high; culms 3-8 mm. in diameter, transversely marked with joint-like septa, terminated by a dense spike, 1-3 cm. long.

Graham 265 was found growing in the water near the river shore with *Montrichardia arborescens*. The two species form a characteristic fringe at the river shores throughout the region.

Vicinity of Kartabo, July 14, 1924, *Graham 265*.

Range: Mexico to Uruguay.

6. FIMBRISTYLIS Vahl

1. *Fimbristylis miliacea* Vahl, Enumeratio Plantarum 2: 287. 1805.

A slender glabrous annual 2-6 dm. high; leaves linear, less than 2 mm. broad, as tall as the flowering culms; spikes loosely arranged in spreading compound umbels.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3046*.

Range: Throughout the tropics.

7. DICHROMENA Michaux

1. *Dichromena pubera* Vahl, Enumeratio Plantarum 2: 241. 1806.

A tufted sedge from fibrous roots, 2-4 dm. high; leaves linear, 10-15 cm. long, 1-2 mm. broad, margin involute; bracts 2-4, 2-5 cm. long, and often conspicuously white in color.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1668*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1915*.

Range: Tropical America.

8. HYPOLYTRUM L. C. Richard

1. *Hypolytrum sylvaticum* Poeppig and Kunth, Enumeratio Plantarum 2: 270. 1837.

Hypolytrum punctatum Nees, in Martius, Flora Brasiliensis 2¹: 66. 1842.

A sturdy plant about 1 m. high; leaves lanceolate, 30-60 cm. long, 1-2 cm. broad; panicles dense, 6-8 cm. broad; seeds verrucose, striking dull white in color.

Graham 154 was collected at the edge of a pond and was about 1 m. high.

Vicinity of Kartabo, July 5, 1924, *Graham 154*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2996*.

Range: Northern South America.

9. RYNCHOSPORA Vahl.

- 1.
- Rynchospora barbata**
- Kunth, Enumeratio Plantarum 2: 290. 1837.

BEAK-SEDGE

A small tufted sedge 1-4 dm. high; leaves linear, one-fourth to three-fourths as long as the culms; heads several to many, 5-10 mm. long.

Sand clearing, Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 148.

Range: American tropics from Panama to Brazil.

10. SCLERIA Bergius

Flowers in loose simple panicles:

Achene black-purple.....1. *S. melaleuca*

Achene white:

Achene tipped with the persistent hair-like style.....2. *S. secans*

Achene tipped with the hard style persisting as a pointed beak....3. *S. mitis*

Flowers in dense compound panicles:

Panicle ovate-conical.....4. *S. macrogyne*

Panicle oblong-cylindrical.....5. *S. cymosa*

- 1.
- Scleria melaleuca**
- Schlechtendal and Chamisso, Linnæa 6: 29. 1831.

Plant from a horizontal rhizome with culms 3-8 dm. high; leaves linear, 2-3 dm. long, somewhat scabrous on the margin and midrib; panicle loose, simple; seed shiny, deep purple-black, about 2 mm. long.

Jungle clearing, vicinity of Kartabo, July 5, 1924, *Graham* 158; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1636.

Range: Throughout the American tropics.

- 2.
- Scleria secans**
- (Linnæus) Urban, Symbolæ Antillanæ 2: 169. 1900.

RAZOR GRASS

Schænus secans Linnæus, Systema Naturæ ed. 10. 2: 865. 1759.

Scleria flagellum var. *nigrorum* Bergius, Vetenskaps-Akademiens nya Handlingar, Stockholm 26: 144. 1765.

Scleria flagellum Swartz, Prodrromus Descriptionum Vegetabilium Indiæ Occidentalis 1: 18. 1788.

Plant with elongate climbing stem; leaves linear, 2-3 dm. long, 8 mm. wide, scabrous; panicle loose, simple; seed white, shiny, with a persistent style.

This is a common characteristic climber found clambering over

undergrowth at the edges of clearings, frequently forming very dense tangles. The leaves and stems are well armed with small recurved spines which are quite strong enough to lacerate the flesh, whence the common name.

Vicinity of Kartabo, July 18, 1924, *Graham 280*.

Range: American tropics.

3. **Scleria mitis** Bergius, Kongliga Svenska Vetenskaps-Akademiens nya Handlingar, Stockholm **26**: 145. 1765; not *S. mitis* Grisebach 1864.

Ophryoscleria mitis Nees, in Martius, Flora Brasiliensis **2**¹: 185. 1843.

A robust sedge 1-2 m. high; leaves lanceolate, 3-5 dm. long, 1-2.5 cm. broad, margin and midrib scabrous; panicle loose, 3-5 dm. long; seed shiny, cream-white, tipped with the stiff, black persistent style.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3045*.

Range: Tropical America.

4. **Scleria macrogyne** C. B. Clarke, Kew Bulletin, Additional Series **8**: 59. 1908.

A robust sedge 1-2 m. high, culm distinctly 3-angled; leaves lanceolate-linear, margin and midrib scabrous, 1.5-3 dm. long, .5-1.5 cm. broad; panicle large, dense, compound, cone-shaped.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2690*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3035*.

Range: British Guiana.

5. **Scleria cymosa** (Brogniart) Boeckeler, Videnskabelige Meddelelser, Kjöbenhavn **155**. 1869.

Becquerelia cymosa Brogniart, in Duperrey, Voyage La Coquille **2**: 161. 1829.

Becquerelia verruculosa Nees, in Martius, Flora Brasiliensis **2**¹: 191. 1843.

A robust sedge about 1 m. high; leaves lanceolate, up to 1 m. long, 1-2 cm. broad, midrib and margin scabrous; panicle dense, compound, oblong-cylindrical, about 3 dm. long.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2939*.

Range: Guianas and Brazil.

13. PALMÆ. Palm Family¹⁰

a. Leaves fan-shaped:

b. Leaf-segments infolded in the bud; spadices interfoliaceous.

1. *LODOICEA*

bb. Leaf-segments folded back in the bud; spadices terminal or axillary.

2. *MAURITIA*

aa. Leaves not fan-shaped, pinnately divided, with 2-many segments, or blades bifid at the apex:

b. Plants armed with long spines:

c. Plants scandent; terminal portion of the leaf rachis naked, armed with reflexed spines.....3. *DESMONCUS*

cc. Plants erect; leaf rachis with segments to the tip, without reflexed spines:

d. Staminate flowers sunk in pits in the rachis.....4. *ASTROCARYUM*dd. Staminate flowers not sunk in pits in the rachis.....5. *BACTRIS*

bb. Plants unarmed, except sometimes on the petioles:

c. Fruit covered with large pyramidal tubercles; trunk short; leaves pinnatisect; spadices several; flowers of both sexes borne on the same spadix.

6. *MANICARIA*

cc. Fruit not tuberculate:

d. Fruit very large, usually over 20 cm. in diameter.....7. *COCOS*

dd. Fruit much smaller:

e. Inflorescences inserted below the leaves:

f. Spathes 2; plants without prop roots; leaf segments acuminate:

g. Petals of the pistillate flowers connate at the base; trunk massive, often swollen or bulging; inflorescence twice branched.

8. *OREODOXA*

gg. Petals free; trunk slender, not swollen; inflorescence once branched:

h. Fruit ovoid:

i. Stigmas excentric; branches of spadix erect-spreading.

9. *JESSENIA*

ii. Stigmas apical; branches of spadix pendulous.

10. *ÆNOCARPUS*

hh. Fruit globose:

i. Stigmas excentric or lateral; branches of spadix erect-spreading; leaf sheath elongate cylindric...11. *EUTERPE*ii. Stigmas basal; branches of spadix pendulous; leaf sheath short, inflated, open.....10. *ÆNOCARPUS*ff. Spathes numerous; plants with large prop roots; leaf segments wedge-shaped.....12. *IRIARTEA*

¹⁰Although only *Cocos* is represented by a specimen in the Herbarium it was thought advisable to include a key to those genera which are known to occur in the region together with some notes on the species reported. The key is adapted chiefly from Standley (1928).

ee. Inflorescences inserted among living leaves:

f. Plants small, slender; leaves usually 1-2 m. long; trunk very slender or none..... 13. *GEONOMA*

ff. Plants large; leaves several meters long; trunk very short, thick, or elongate..... 14. *ATTALEA*

1. LODOICEA Commelin

Lodoicea sechellarum Labillardière, the Double Coconut, Coco de Mer, or Coco des Maldives, is a native of the Seychelle Islands, a specimen of which may be seen in the Georgetown Botanic Gardens. See p. 32.

2. MAURITIA Linnæus filius

Mauritia flexuosa Linnæus, the Ité, Ita, Eta or Æta, is one of the most abundant of the native British Guiana palms. Beebe (1925) reports it near the river's edge at Kartabo and states that the "dry, pithy stems of the petioles make excellent razor strops." It is a tall plant with a stout stem and crown of large green palmate leaves. The fruits are small, about 2.5 cm. in diameter and occur in large clusters. It grows best in low land which is flooded in the wet seasons. The Indians make their tibireri or tisisiri fiber for hammocks from the young unfolded leaves.

3. DESMONCUS Martius

Desmoncus macroacanthus Spruce, the Kamawarri, is a native trailing palm listed by British Empire Exhibition (1924). It has prolonged midribs covered with long reflexed thorns. Hitchcock (1921) mentions this plant as a great nuisance to the collector along the coast on account of the long armed midribs which dangle in the air.

4. ASTROCARYUM Meyer

Astrocaryum tucuma Martius, the Akuyuro, Acqueero or Cuyuru Palm is a tall, thorny plant. Beebe (1925) reports one near the Kartabo laboratory. He also states that the fruit is eaten by Indian children and animals.

Astrocaryum tucumoides Drude, the Awarra, is mentioned by British Empire Exhibition (1924) as is **Astrocaryum jauari** Martius, the Sawarai Palm.

5. BACTRIS Jacquin

Bactris (Guilielma) speciosa Karsten, the Paripi Palm, is reported by British Empire Exhibition (1924) as cultivated by the natives who use the plant in their hut construction. The same authority lists **B. major** Jacquin and **B. flavispina** Hort. which are known as Pimpler Palms because of their long stout spines. They are native to the colony and grown in Georgetown.

6. MANICARIA Gärtner

Manicaria saccifera Gärtner, the Truli, is a native of British Guiana reported by British Empire Exhibition (1924) as a very common plant in the Northwest and Pomeroun Districts. It has large pin-natisect leaves which are used by the natives for thatching.

7. COCOS Linnæus

1. **Cocos nucifera** Linnæus, Species Plantarum 1188. 1753.

COCONUT

The Coconut Palm is cultivated throughout the colony and is found in nearly every river settlement of the Kartabo region. *Graham 264* was collected at a small village along the shore of the Mazaruni River just east of Kartabo.

Vicinity of Kartabo, July 14, 1924, *Graham 264*.

Range: Throughout the tropics; home unknown.

8. OREODOXA Martius

Oreodoxa (Roystonea) regia Humbolt, Bonpland, and Kunth, the Royal Palm, which is native to Florida and Cuba, is cultivated in Georgetown. There one also sees the Cabbage Palm, **Oreodoxa (Roystonea) oleracea** (Jacquin) Martius. A stately avenue of Cabbage Palms thrives across the river from Kartabo at the Penal Settlement. They are native to the East Indies and are similar in appearance to the Royal Palms but the Cabbage Palm differs from the Royal in that it is much taller, reaching 30 m., does not have a decided bulge to the trunk, and the leaf segments spread in one plane instead of in many. The fruits of the Cabbage Palm are slightly curved and nearly 15 cm. long while those of the Royal are globose and rarely over 10 cm. in length.

9. *Jessenia* Karsten

Jessenia oligocarpa Grisebach and A. Wendland, the Turu Palm, is reported from the Kartabo jungle by Hingston (1932). It is a high unarmed palm with pinnatisect leaves and alternate, linear-lanceolate leaf segments that are 8 cm. broad by nearly a meter in length. Hingston reports that the tuft of young leaves in the heart of the crown is eaten like cabbage.

10. *Ænocarpus* Martius

Ænocarpus bacaba Martius is given by the British Empire Exhibition (1924) as the Turu Palm. The same authority states that a delightful drink is made from the fruit. It is a native of the Guianas.

11. *Euterpe* Gærtner

Euterpe edulis Martius, the Manicole Palm, is a native listed by the British Empire Exhibition (1924) as widely distributed in swamps throughout the colony, in some places constituting almost a pure stand of trees. The plant consists of a clump of 6-12 stems, their pinnatisect leaves very graceful and feathery, with light green leaflets. This species or a closely related species is known in the colony as Rehu. A Water Manicole with odd twin leaves reported by Hingston (1932) may be a *Euterpe*.

12. *Iriarteia* Ruiz and Pavon

Iriarteia exorrhiza Martius, the Buba or Stilt Palm, which grows singly and has aerial stilt roots, is reported by British Empire Exhibition (1924). It is believed to be naturally distributed from Costa Rica to Brazil, has a smooth green trunk 3-6 m. high or higher, with a crown of few long leaves having numerous, somewhat wedge-shaped, irregularly toothed divisions. The leaf sheaths form a bulge at the top of the trunk below which hang the few-branched inflorescences.

13. *Geonoma* Willdenow

Geonoma baculifera Kunth, the Dahlibanni, inhabits eastern British Guiana and occurs along the Essequibo, according to British Empire Exhibition (1924). It is a small palm native to the colony with a slender trunk and long pinnatisect leaves which are used for thatching.

14. ATTALEA Humbolt, Bonpland, and Kunth

Attalea (Maximiliana) amygdalina Humbolt, Bonpland, and Kunth, the Kokerit Palm, Beebe (1925) reports near Kartabo, its seedlings especially common. It is generally regarded as the grandest of all British Guiana palms. When young the large feathery leaves rise almost straight from the ground but when the stem has developed to some height the leaves, sometimes 6 m. long, resemble great ostrich plumes as they sway in the wind.

14. ARACEÆ. Arum Family

Leaves peltate 1. *CALADIUM*

Leaves not peltate:

Flowers with a perianth. 2. *SPATHIPHYLLUM*

Flowers without a perianth. 3. *MONTRICHARDIA*

1. CALADIUM Ventenat

1. **Caladium bicolor** (Aiton) Ventenat, Description des Plantes Nouvelles ou peu Connues de Jardin de J. M. Cels pl. 30. 1800.

Arum bicolor Aiton, Hortus Kewensis 3: 316. 1789.

A generally terrestrial plant; leaves smooth, peltate, heart-shaped, usually 10-20 cm. long, but sometimes much larger; spathe a little longer than the spadix; flowers unisexual; fruit a white berry.

This plant and other species of the genus are often planted for ornament, as their leaves are handsomely spotted with red and white, and are regarded as "beenas" or talismans by the natives. *Graham 414* is a vegetative specimen but obviously is to be assigned to this species or one of its many varieties. It was collected in the clearing at the Kartabo laboratory.

Vicinity of Kartabo, August 3, 1924, *Graham 414*.

Range: American tropics.

2. SPATHIPHYLLUM Schott

1. **Spathiphyllum cuspidatum** Schott, Oesterreichisches Botanisches Wochenblatt 7: 158. 1857.

A stemless terrestrial plant; leaves oblong-elliptic, 3-5 dm. long, abruptly acuminate; spadix spike-like, dense, about 1 dm. long.

Graham 310 was found at the edge of a fresh-water creek and was a little over 1 m. high.

Vicinity of Kartabo, July 21, 1924, *Graham 310*.

Range: Guianas.

3. MONTRICHARDIA Crueger

1. **Montrichardia arborescens** (Linnæus) Schott, Araceen Betreffendes 1: 4. 1854. MUCKA-MUCKA (See Plate VII)

Arum arborescens Linnæus, Species Plantarum 967. 1753.

A tall robust plant; leaves large, broadly ovate-sagittate, the basal lobes acute; flowers yellow, borne on a spadix enclosed by a white or greenish-yellow spathe 20-30 cm. long.

This striking arum is very common along the rivers' edges where it grows in the water or on the muddy shore and attains a height of 3 m. or more.

Vicinity of Kartabo, July 14, 1924, *Graham 263*.

Range: Tropical America.

Montrichardia aculeatum Schott, a species found in similar situations along the shore, is reported by British Empire Exhibition (1924). It is often treated as a variety of *M. arborescens*, differing chiefly in its size, as it is from 7 to 9 m. tall, and in its stems, which are thorny, at least above.

Pistia stratiotes Linnæus, the Water Lettuce, is reported by Hitchcock (1921) as occurring in the water of ditches about settlements along the coast. It is a floating stoloniferous herb, stemless with fibrous roots and monoecious flowers. The leaves are pubescent, in a rosette, sessile, ovate to obovate, narrowed into a petiole-like base, from 3-12 cm. long. The spathes are pale green or whitish, about 1.5 cm. long.

Monstera pertusa (Linnæus) De Vriese, or a very large epiphytic arum closely resembling it, was observed by the writer near Kartabo. It was growing in the crotch of a great tree and no specimen was obtained.

Colocasia esculenta Schott, or related species, furnish the Eddo and Tannia so much used by the people of the colony in soups and as potatoes are used generally. The tubers are the parts of the plants used.

15. MAYACACEÆ. Mayaca Family

Mayaca sp. is reported by Hitchcock (1921) as a frequent plant in the marshes and streams along the coast. It is an aquatic plant with

slender stems 4-30 cm. long, in general resembling a moss plant. The flowers have 3 sepals and 3 petals and are borne on slender pedicels in the axils of the linear leaves.

16. XYRIDACEÆ. Yellow-eyed Grass Family

1. XYRIS Linnæus

Bracts acute to acuminate; leaves nearly as long as the flower stems; lateral sepals 5-7 mm. long, their margins membranous, brown, the keel conspicuously fimbriate or subciliate along the upper two-thirds. 1. *X. macrocephala*

Bracts not acute, broadly ovate to truncate; leaves one-half to three-fourths as long as the flower stems; lateral sepals 4-5 mm. long, their margins thin and hyaline, the keel minutely fimbriate or denticulate on the upper third.

2. *X. Jupicai*

1. ***Xyris macrocephala*** Vahl, Enumeratio Plantarum 2: 204. 1806.

A rush-like herb 1 m. or less high; leaves linear, half as long as the stems, .5-1 cm. broad; flowers yellow, in a single spike 1-2 cm. long surmounting the stem; fruit a 3-valved capsule.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1904.

Range: Guianas.

2. ***Xyris Jupicai*** L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 106. 1792.

A rush-like herb 1 m. high or less; leaves linear, 2.5-5.5 mm. broad; stem surmounted by a single spike 1-2 cm. long; flowers yellow; fruit a 3-valved capsule.

Similar to *X. macrocephala* but with slightly narrower leaves and the lateral sepals included.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1880.

Range: Maryland and Texas to Paraguay and Uruguay.

17. ERIOCAULACEÆ. Pipewort Family

1. TONINA Aublet

1. ***Tonina fluviatilis*** Aublet, Histoire des Plantes de la Guiane Francoise 2: 856. 1775.

Hyphydra amplexicaulis Vahl, Symbolæ Botanicae 3: 99. 1794.

A stemless herb 1-3 dm. high; leaves linear-lanceolate, alternate, clasping, delicate, 5-15 mm. long, 2 mm. broad; flowers borne on long peduncles in the axils of the leaves.

This plant is a common one in the Kartabo region and occurs in the water or along the sandy shores of the rivers or along the sandy stretches of the jungle trails.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham 399*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 2006*.

Range: Tropical America.

18. RAPATEACEÆ.

1. RAPATEA Aublet

1. **Rapatea paludosa** Aublet, *Histoire des Plantes de la Guiane Françoise* 1: 305. 1775.

Mnasion paludosum Willdenow, *Species Plantarum* 2: 22. 1799.

A stemless herb about 1 m. high; leaves lanceolate, 6-9 dm. long, attenuate into a very slender apex, tapering at the base; flowers yellow, in a head which is inclosed in 2 or more large, tapering, leaf-like bracts.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1901*.

Range: American tropics.

19. BROMELIACEÆ. Pineapple Family

Fruit a berry, indehiscent; ovary inferior. 1. *ÆCHMEA*

Fruit a capsule, dehiscent; ovary superior or nearly so:

Seeds winged, or appendaged 2. *PITCAIRNIA*

Seeds with a long, plumose appendage 3. *GUZMANIA*

1. *ÆCHMEA* Ruiz and Pavon

1. **Æchmea humilis** Mez, in *DeCandolle, Monographiæ Phanerogamarum* 9: 216. 1896.

A stemless epiphytic herb usually less than 2 dm. high; leaves large, 25 cm. long, spine-toothed; bracts of the inflorescence large, reflexed, reddish, showy; seeds without wings or plumes.

Graham 121 was taken from the limb of a tree about 3 m. from the ground and its leaf bases were filled with stinging ants.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 121*.

Range: British Guiana.

2. PITCAIRNIA L'Heritier

1. **Pitcairnia Kegelianae** Schlechtendal, Linnæa **24**: 664. 1851.

A stemless epiphytic or terrestrial herb; leaves all alike, linear, 6-8 dm. long, 13 mm. broad; scape slender, erect; inflorescence a white-farinose, few-flowered raceme; petals scarlet.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2744.

Range: Guianas.

3. GUZMANIA Ruiz and Pavon

1. **Guzmania lingulata** (Linnæus) Mez, in DeCandolle, *Monographiæ Phanerogamarum* **9**: 899. 1896.

Tillandsia lingulata Linnæus, *Species Plantarum* 286. 1753.

A stemless, epiphytic herb 3 dm. high; leaves ligulate-lanceolate, 3-4 dm. long, 3-4 cm. broad; scape stout, erect, with densely imbricated leaf-like bracts, the outer reddish and concealing the flowers; capsule subellipsoid, 3 cm. long.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1877.

Range: Central America and the Antilles southward to Venezuela and Colombia.

Bromelia spicata Lamarck, the Wild Pineapple, is reported by British Empire Exhibition (1924) from the colony although recent treatments of the Bromeliaceæ, such as that of Smith (1930), make no mention of its occurrence in British Guiana.

Tillandsia usneoides Linnæus, the Spanish Moss or Old Man's Beard, is reported by British Empire Exhibition (1924). This gray, tomentose moss-like epiphyte is not of frequent occurrence in the colony, even along the coast where one might expect it.

Beebe (1925) reports that in the water held by the leaves of various species of the Bromeliaceæ he has found *Euglena*, *Ceratium*, *Volvox*, *Chlamydomonas*, *Amæba*, *Arcella*, *Gonium* (?), *Paramæcium*, *Hydra*, *Rotifers* and *Oligochæte*, and that damsel flies and mosquitoes breed there.

20. COMMELINACEÆ. Spiderwort Family

Flowers inclosed in a compressed spathe or spathes:

Fruit indehiscent, crustaceous, white or blue; corolla white.

1. *ATHYROCARPUS*

Fruit dehiscent, greenish; corolla blue 2. *COMMELINA*

Flowers not inclosed in a spathe, often subtended by bracts, but these not compressed 3. *DICHORISANDRA*

1. *ATHYROCARPUS* Schlechtendal

1. *Athyrocarpus persicariæfolius* (DeCandolle) Hemsley, *Biologia Centrali-Americana* 3: 386. 1885.

Commelina persicariæfolia DeCandolle, in Redouté, *Liliacées* 8: pl. 472. 1816.

Phaospherion persicariæfolium C. B. Clarke, in DeCandolle, *Monographiæ Phanerogamarum* 3: 137. pl. 5, f. 2. 1881.

A delicate succulent herb; leaves alternate, ovate-acuminate, 10 cm. long, 2 cm. broad; leaf sheaths provided with long hairs, brownish in color; spathes conduplicate, the valves semi-orbicular, 2-2.5 cm. long; fruit ellipsoid or subglobose, grayish-white, shiny.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2897.

Range: West Indies to Colombia and Peru.

2. *COMMELINA* Linnæus

1. *Commelina longicaulis* Jacquin, *Collectanea ad Botanicum* 3: 234. 1789. CREEPING DAYFLOWER

A small, trailing herb which roots at the nodes; leaves lanceolate to ovate-lanceolate, 3-8 cm. long, .5-1.5 cm. broad; leaf sheaths provided with soft, light-colored hairs; flowers few in each spathe, blue, small, on slender, exserted peduncles.

Matope Falls, Cuyuni River, July 24, 1924, *Graham* 352; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2917.

Range: Throughout the tropics.

3. *DICHORISANDRA* Mikan

1. *Dichorisandra hexandra* (Aublet) Standley and Calderón, *Lista Preliminar de las Plantas El Salvador* 48. 1925.

Commelina hexandra Aublet, *Histoire des Plantes de la Guiane Française* 1: 35. pl. 12. 1775.

An erect herb 1 m. high or more; leaves alternate, ovate, acuminate, 10 cm. long, 3 cm. broad, from prominent pubescent leaf sheaths 2 cm. long; panicles terminal; sepals 3, white; petals 3, blue; anthers 6, blue.

Graham 394 was a woody climber nearly 2 m. high, collected at the edge of a jungle clearing.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham 394*.

Range: Salvador and the Guianas.

21 PONTEDERIACEÆ. Pickerel-weed Family

1. EICHHORNIA Kunth

1. *Eichhornia diversifolia* Urban, Symbolæ Antillanæ 4: 147. 1903.

WATER HYACINTH

Heteranthera diversifolia Vahl, Enumeratio Plantarum 2: 44. 1806.

Piaropus diversifolius P. Wilson, Scientific Survey of Porto Rico and the Virgin Islands 5: 149. 1923.

An aquatic plant with an elongate, slender, floating stem; leaves small, cordate, 2-3 cm. in diameter, petioles 4-6 cm. long, the submerged leaves longer, linear, the petioles not inflated as in the floating ones; spathes few-flowered; fruit a many-seeded capsule.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2967*.

Range: West Indies and South America.

Eichhornia azurea Kunth is reported by British Empire Exhibition (1924) from the coastal region. It is a species which does not have inflated petioles.

Eichhornia speciosa Kunth, the common South American Water Hyacinth, probably also occurs in the region. It has pale violet flowers and leaves in a basal tuft, the petioles usually inflated. Its range extends from Florida and Bermuda throughout tropical America.

22. LILIACEÆ. Lily Family

1. SMILAX Linnæus

1. *Smilax Schomburkiana* Kunth, Enumeratio Plantarum 5: 187. 1850.

GREENBRIER

A non-prickly climber; leaves ovate to elliptic, 3-ribbed, 12-18 cm. long, 7-10 cm. broad; flowers in scattered, axillary umbels; fruit an orange berry.

The sarsaparilla of commerce is obtained from the dried roots of several species of South American and Mexican *Smilax*.

Vicinity of Kartabo, July 19, 1924, *Graham 305*.

Range: Guianas.

Gloriosa superba Linnæus, the Gloriosa or Climbing Lily, is reported by Hitchcock (1921) as a cultivated plant at Georgetown. It is a native of the Asiatic tropics and is a herbaceous vine with thin, lanceolate leaves and spirally twisted, yellowish red perianth divisions.

23. HÆMODORACEÆ. Bloodwort Family

1. XIPHIDIUM Lœffling

1. **Xiphidium cœruleum** Aublet, Histoire des Plantes de la Guiane Françoise 1: 33. 1775.

A somewhat succulent herb 30-50 dm. high; leaves broadly linear, 20-50 cm. long, 1-3 cm. broad, from a sheathing base, scabrous on the margins; raceme spreading, terminal, of white flowers; fruit a capsule 5-6 mm. in diameter.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham 396*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1856*; Pomeroon District, Tabla, September 28, 1921, *De La Cruz 1227*.

Range: American tropics.

24. AMARYLLIDACEÆ. Amaryllis Family

Filaments not united into a staminal cup..... 1. *CRINUM*
Filaments united into a staminal cup by appendages at their bases.

2. *PANCRA TIUM*

1. *CRINUM* Linnæus

1. **Crinum commelyni** Jacquin, Plantarum Rariorum Horti Cæsarei Schœnbrunnensis et Icones 2: 40. pl. 202. 1797-1804.

A succulent, acaulescent herb 1 m. high or less; leaves lanceolate, 40 cm. or more in length, scabrous on the margin; umbel of 2-6 showy, white flowers; tube of the perianth 10-15 cm. long, the segments reflexed-spreading.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1943*.

Range: South American tropics.

2. *PANCRATIUM* Linnæus

- 1.
- Pancratium guianense*
- Ker, Botanical Register 4: pl. 265. 1818.

SPIDER LILY

Hymenocallis amancæs Nicholson, The Illustrated Dictionary of Gardening 2: 165. 1887.

A succulent, acaulescent herb 1 m. high or less; leaves thin, ovate-lanceolate, entire, long-petioled, acuminate at the apex, 30 cm. long or longer; flowers white, in a several-flowered umbel; perianth tube 15-20 cm. long, the segments ascending, the stamens joined by a web or cup.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 218*.

Range: Northern South America.

25. TACCACEÆ.

1. *TACCA* Forster

- 1.
- Tacca Parkeri*
- Seemann, Flora Vitiensis 102. 1865.

A herbaceous plant; leaves long-stalked, ovate, acuminate, broadest below the middle; scape long, slender, surmounted by an umbel-like inflorescence which is provided with conspicuous, leaf-like bracts; flowers trimerous, regular, hermaphrodite; fruit a berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3018*.

Range: Guianas.

26. DIOSCOREACEÆ. Yam Family

1. *DIOSCOREA* Linnæus

Leaves thin, paper-like.....1. *D. polygonoides*

Leaves thick, not paper-like:

Veins forming distinct reticulations; leaves gradually acuminate.

2. *D. amazonum*

Veins not forming distinct reticulations; leaves abruptly acuminate.

3. *D. trichanthera*

1. *Dioscorea polygonoides* Humbolt and Bonpland, in Willdenow, Species Plantarum 4: 795. 1805.

A climbing plant; leaves alternate, thin, hastate, 4-8 cm. long, attenuate at the apex; flowers in loose, axillary, spike-like racemes; fruit a 3-angled capsule about 2 cm. long.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2995; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3052.

Range: American tropics.

2. **Dioscorea amazonum**, Grisebach, in Martius, *Flora Brasiliensis* 3¹: 39. 1842.

A climbing plant; leaves alternate, thick, cordate, attenuate at the apex, with 3-5 prominent nerves, lighter below; flowers short-pedicelled, in spike-like racemes; fruits in very dense, cylindrical clusters.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2642; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2692.

Range: Northern South America.

3. **Dioscorea tricanthera** Gleason, *Bulletin of the Torrey Botanical Club* 52: 182. 1925.

A climbing plant; leaves alternate, thick, elongate, cordate, abruptly acuminate, with 3-5 prominent nerves; staminate racemes single, pubescent, unbranched, 10-20 cm. long, in the axils of the upper leaves; pistillate unknown.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2646.

Range: British Guiana.

Stems and tubers of **Dioscorea trifida** Linnæus, the Cush-cush, and **D. cayenensis** Lamarck are used as arrow poisons in British Guiana and the Dutch West Indies, according to Cheney (1931).

Tubers of various species of *Dioscorea* furnish the yams so much used in the colony for food because of the abundant starch they contain. A bitter principle is removed by washing.

27. MUSACEÆ. Banana Family

1. HELICONIA Linnæus

1. **Heliconia acuminata** L. C. Richard, *Nova Acta Academia, Naturæ Curiosorum Suppl.* 15: pl. 11, 12. 1831.

Bihai acuminata O. Kuntze, *Revisio Generum Plantarum* 2: 684. 1891.

A coarse herb 2-6 m. high; leaves smooth, oblong-elliptic, 20-40 cm. long, 6-15 cm. broad; inflorescence 30 cm. long or longer; flowers clustered in the axils of long, narrow, showy yellow and red bracts which are placed at intervals on a zig-zag rachis.

This is a common and characteristic plant of the Kartabo jungle. The bracts hold water and are the breeding places of mosquitoes, protozoans and other invertebrates.

Vicinity of Kartabo, July 1924, *Graham* 99; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1583.

Range: Northern South America.

Ravenala madagascariensis J. F. Gmelin, the Traveler's Tree (*See* Plate IV), is a conspicuous tree in the Georgetown Botanic Garden, and may be recognized by its fan-like spread of banana-like leaves which radiate in a single plane from a stout trunk. It is a native of Madagascar. A native species, **R. guyanensis** Steudel, occurs in the jungle near Kartabo and is mentioned by J. G. Meyers (1930). It differs from *R. madagascariensis* by having the leaves as long as, instead of shorter than, the petioles.

Musa sapientum Linnæus, the Banana, is a staple food in the colony, either raw, fried, or roasted, while **M. paradisiaca** Linnæus, the Plantain, is as much used, but edible only when cooked. The plantain differs from the banana in having larger fruits which are not angled and male flowers which are not deciduous. Both are natives of India.

28. ZINGIBERACEÆ. Ginger Family

Corolla white; lateral staminodes large and petal-like.....1. **HEDYCHIUM**
Corolla not white, yellow-purple; lateral staminodes small, tooth-like or none,
rarely longer, narrow and adnate to the labellum.....2. **COSTUS**

1. HEDYCHIUM Koenig

1. **Hedychium coronarium** Koenig, in Retzius, *Observationes Botanicae*
3: 73. 1783. GINGER LILY

A leafy-stemmed herb 1-2 m. high; leaves lanceolate, 2.5-5 dm. long, 5-9 cm. broad; inflorescence a bracteate spike of fragrant white flowers which are 8-10 cm. in diameter; fruit an oblong, glabrous capsule.

This species occurs in large dense communities along the river shores, especially in cleared spots near the villages.

Near Bartica, vicinity of Kartabo, July 26, 1924, *Graham* 357.

Range: Native to tropical Asia but naturalized in tropical America.

2. *COSTUS* Linnæus1. *Costus cylindricus* Jacquin, *Fragmenta Botanica* 54. 1809.

CONGO CANE

A robust leafy-stemmed herb 1-4 m. high; leaves ovate to oblanceolate, pointed at both ends, 20-30 cm. long, 5-10 cm. broad; inflorescence a terminal spike, often 15 cm. long, of closely imbricated reddish bracts; flowers yellow or purplish; fruit a triangular capsule 1.5 cm. long.

In this genus the stem is formed of the tightly rolled sheaths of the leaves. The common name listed is one which the writer heard given to the plant by the half-caste natives.

Vicinity of Kartabo, July 1924, *Graham 161*.

Range: Northern South America.

29. CANNACEÆ. Canna Family

1. *CANNA* Linnæus1. *Canna coccinea* Miller, *Gardener's Dictionary* ed. 8. 1768. CANNA

A slender leafy-stemmed herb 1-2 m. high; leaves large, ovate to oblong-lanceolate, up to 5 dm. long; flowers red, in spreading simple racemes; capsule 2-3 cm. long, covered with short, stiff bristles; seeds black, shot-like.

This species is frequently cultivated as an ornamental.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1955*.

Range: Central and South America.

30. MARANTACEÆ. Arrowroot Family

Ovary 3-celled, the fruit 3-seeded.....1. *CALATHEA*

Ovary 1-celled, the fruit 1-seeded:

Stamens 2, rarely none.....2. *MARANTA*

Stamens solitary:

Flowers in pairs.....3. *ISCHNOSIPHON*

Flowers solitary, not in pairs.....4. *MONOTAGMA*

1. *CALATHEA* G. F. W. Meyer

Bracts closely imbricated into a solid head.....1. *C. cyclophora*

Bracts not closely imbricated into a solid head.....2. *C. elliptica*

1. *Calathea cyclophora* Baker, *Kew Bulletin* 1895: 17. 1895.

A stemless herb 2 m. high or less; scape 15-30 cm. long, shorter than the petiole of the generally single, ovate-oblong leaf; flowers pink or

white, exerted from closely imbricated bracts which terminate the scape.

Graham 115 was collected in second growth jungle along a trail.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 115*; Pomeroun River, Pomeroun District, January 14-20, 1923, *De La Cruz 2913*.

Range: British Guiana.

2. ***Calathea elliptica*** (Roscoe) K. Schumann, *Das Pflanzenreich* 11 (IV. 48): 75. 1902.

Phrynium ellipticum Roscoe, *Monandrian Plants* pl. 44. 1828.

A stemless herb 2 m. high or less; leaves obliquely pointed, oblong-elliptic, on petioles which are longer than the blade; inflorescence a terminal, loosely arranged spike-like cluster; flowers exerted from bracts which are 2-3 cm. long.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1900*.

Range: Guianas.

2. MARANTA Linnæus

1. ***Maranta Ruiziana*** Kœrnicke, *Bulletin de la Société Impériale des Naturalistes de Moscou* 35¹: 45. 1832. ARROWROOT

A much-branched herb about 1 m. high; leaves ovate-triangular, 5 cm. long, 2-3 cm. broad; flowers white, about 2.5 cm. long.

A food starch, Arrowroot, is obtained from the roots of this and other species of the genus, especially ***M. arundinacea*** Linnæus, a native of northern South America.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 2005*.

Range: Northern South America.

3. ISCHNOSIPHON Kœrnicke

Leaves small, less than 20 cm. long, triangular-ovate..... 1. *I. surinamensis*

Leaves large, more than 20 cm. long, oblong..... 2. *I. Arouma*

1. ***Ischnosiphon surinamensis*** (Miquel) Kœrnicke, *Bulletin de la Société Impériale des Naturalistes de Moscou* 35¹: 93. 1862.

Maranta surinamensis Miquel, *Linnæa* 18: 603. 1844; 22: 79. 1849.

A robust herb with enlarged nodes; leaves 12-16 cm. long, 5-8 cm. broad, triangular-acuminate, the base truncate, the appressed petiole spreading into a clasping sheath; flowers yellow and purple, in a slender spike 10-15 cm. long.

Certain species of the genus are used in basket making.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' \text{ N.}$,

July 15-19, 1922, *De La Cruz* 1624.

Range: Northern South America.

2. **Ischnosiphon Arouma** (Aublet) Kærnicke, Bulletin de la Société Impériale des Naturalistes de Moscou **35**¹: 88. 1862.

Maranta Arouma Aublet, Histoire des plantes de la Guiane François 1: 3. 1775.

A robust herb 2-3 m. high; leaves oblong, 30-50 cm. long, 12-20 cm. broad, obliquely pointed with a curved midrib at the apex; flowers yellow in a slender spike 25-30 cm. long.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$,
July 15-19, 1922, *De La Cruz* 1653.

Range: West Indies to Brazil.

4. MONOTAGMA K. Schumann

1. **Monotagma Parkeri** (Roscoe) K. Schumann, Das Pflanzenreich 11 (IV. 48): 168. 1902.

Phrynium Parkeri Roscoe, Monandrian Plants pl. 42. 1828.

A robust herb about 1 m. high; leaves long-petioled, 20 cm. long or more, 10 cm. broad, oblong, obliquely pointed with a curved midrib at the apex; flowers white-rose, in rather dense, sometimes branching spikes at the top of a tall scape.

Graham 306 was found growing along the shore where its base was submerged at high tide.

Vicinity of Kartabo, July 21, 1924, *Graham* 306.

Range: Northern South America.

31. ORCHIDACEÆ. Orchid Family

- a. Terrestrial plants.....1. *HABENARIA*
aa. Epiphytic plants:
 b. Leaves less than 3 cm. long, linear to oblong-lanceolate.....2. *DICHÆA*
 bb. Leaves more than 3 cm. long, not linear to oblong-lanceolate:
 c. Inflorescence normally terminal at the tip of a slender or thickened stem.

3. *EPIDENDRUM*

 cc. Inflorescence not terminal:
 d. Flowers numerous in loose panicles sometimes several feet long.

4. *ONCIDIUM*

 dd. Flowers not in long, loose panicles.....5. *AGANISIA*

1. HABENARIA Willdenow

- 1.
- Habenaria longicauda**
- Hooker, Botanical Magazine pl. 2957. 1830.

A terrestrial, subaquatic orchid 1 m. high or more; leaves linear-lanceolate, 20 cm. long, 2 cm. broad; flowers yellow, in a spike 30 cm. long.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2440.

Range: Guianas.

2. DICHÆA Lindley

Leaves oblong, 1 cm. long, 3 mm. broad.....1. *D. picta*

Leaves linear, 2 cm. long, 1-2 mm. broad.....2. *D. Rendlei*

- 1.
- Dichæa picta**
- Reichenbach filius, in Saunder, Refugium Botanicum 2: 84. 1869.

A small epiphytic orchid; leaves clasping, oblong, acuminate, about 1 cm. long, 3 mm. broad; flowers white, in the axils of the leaves.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1930.

Range: West Indies and northern South America.

- 2.
- Dichæa Rendlei**
- Gleason, Bulletin of the Torrey Botanical Club 54: 604. 1927.

A small epiphytic orchid; leaves clasping, linear, acuminate, about 2 cm. long, 1-2 mm. broad; flowers in the axils of the leaves.

This species is similar to the preceding but slightly less robust and with leaves slightly narrower and somewhat longer.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1623.

Range: British Guiana.

3. EPIDENDRUM Linnæus

Leaves oblong-ovate.....1. *E. nocturnum*

Leaves lanceolate to lanceolate-linear:

Leaves 3-5 cm. broad.....2. *E. variegatum*

Leaves 1-2 cm. broad.....3. *E. immatophyllum*

- 1.
- Epidendrum nocturnum**
- Jacquin, Enumeratio Systematica . . . Caribæis 29. 1760.

An epiphytic or rock inhabiting, leafy-stemmed plant; leaves ovate, blunt, 8-10 cm. long, 2-3 cm. broad; flowers large, white, in a short, terminal, few-flowered raceme, perianth divisions linear, spreading, 5

cm. long, 2-3 mm. broad, the lateral sepals linear-attenuate, 40-60 mm. long.

This species, together with **E. fragrans** Swartz and **E. bicornutum** Hooker, are reported by Beebe (1925) as epiphytes abundant upon the Mangrove trees along the river shores near Kartabo.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1879; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1926.

Range: Mexico, Florida and the West Indies southward through Central and northern South America.

2. **Epidendrum variegatum** Hooker, Botanical Magazine pl. 3151. 1832.

A very variable epiphytic plant; leaves thick, leathery, 20-30 cm. long, 3-4 cm. broad; inflorescence terminal, of scattered flowers.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2958.

Range: Cuba and Costa Rica southward through most of northern South America.

3. **Epidendrum imatophyllum** Lindley, Genera and Species of Orchidaceous Plants 106. 1831.

A rather sturdy, epiphytic plant; leaves lorate, 12-18 cm. long, 1-2 cm. broad; inflorescence flat-topped, racemose; flowers pink.

Stanley (1928) reports this species to occur in Panama commonly, if not always, in ant nests.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2021.

Range: Mexico southward through Central and northern South America.

Epidendrum spp. The following unidentified specimens from the Kartabo region are in the herbarium: Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1928; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2419; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2999.

4. **ONCIDIUM** Swartz

Plants small; leaves 2-5 cm. long; flowers in short, loose spikes. . . . 1. *O. pusillum*
Plants large; leaves 20-30 cm. long; flowers in loose panicles several dm. long.

2. *O. Baueri*

1. **Oncidium pusillum** (Linnæus) Reichenbach filius, in Walper, *Annales Botanices Systematicæ* 6: 714. 1861.

Epidendrum pusillum Linnæus, *Species Plantarum* ed. 2. 1352. 1763.

Oncidium iridifolium Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 1: 344. 1815.

A dainty dwarf, tufted plant; leaves lanceolate, elliptic, 4-8 cm. long, less than 1 cm. broad; peduncles equally as long as the leaves; flowers yellow, the lip deeply lobed, in a short, terminal spike.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3034.

Range: Widespread from Mexico to Brazil.

2. **Oncidium Baueri** Lindley, in Bauer, *Genera and Species of Orchideous Plants, Illustrated Genera* pl. 7. 1832.

An epiphytic plant about 2 m. high; leaves lanceolate, 20-30 cm. long, 2-3 cm. broad; flowers yellowish-brown, in loose, spreading panicles which reach a meter in length.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2982; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2985.

Range: Tropical America.

5. AGANISIA Lindley

1. **Aganisia pulchella** Lindley, *Botanical Register N. S. 2: Miscellaneous Notices* 45. 1839.

A slender epiphytic orchid; leaves about 15 cm. long, 4 cm. broad, with 3-5 prominent veins, tapering into a long petiole, the apex acute; flowers light colored, spotted with yellow and purple, arranged in 4-8-flowered racemes.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2000.

Range: Guianas.

A great many more orchids than the number included in this treatment must occur in the Kartabo region. Gleason (1921) mentions **Cyrtopodium** and **Catasetum** as ground orchids in sand areas near Rockstone. They have large, erect pseudobulbs as much as two feet high, surmounted by panicles or racemes of yellow flowers. British Empire Exhibition (1924) gives **Gongora** sp. and **Ionopsis paniculata**

Lindley, the latter with clusters of mauve and white flowers, as common orchids. The same authority also lists the following: *Catasetum longifolium* Lindley and *Vanilla palmarum* Lindley as inhabitants of forest clad islands in open tracts of country; *Vanilla planifolia* Andrews as a tree creeper in the Wallaba forests which is the Vanilla of commerce, native of Mexico but now widely cultivated in tropical countries with a warm damp climate; and the red-flowered *Rodriguezia secunda* HBK. in eastern British Guiana. Although probably never as abundant in this region as at somewhat higher elevations in the colony, many of the orchids of the lowlands have been well-nigh exterminated by commercial orchid hunters, according to the natives. Unidentified specimens of the genera *Zygopetalum* and *Polystachya* are in the herbarium from the Kartabo region.

Ames and Schweinfurth in 1931 identified about 150 species of orchids from British Guiana in the Jenman Herbarium at Georgetown.

Class DICOTYLEDONEÆ. Dicotyledons

32. PIPERACEÆ. Pepper Family

Stigmas 2-5 (mostly 3-4); plants shrubby:

Spikes axillary or terminal; plants suffruticose.....1. *POTHOMORPHE*

Spikes opposite the leaves, solitary; plants woody.....2. *PIPER*

Stigma 1; plants herbaceous.....3. *PEPEROMIA*

1. POTHOMORPHE Miquel

1. *Pothomorphe peltata* (Linnæus) Miquel, *Commentarii Phytographici* 37: 45. 1840.

Piper pellatum Linnæus, *Species Plantarum* 30. 1753.

A shrub 1 m. high or more; leaves large, orbicular, peltate, 20 cm. or more in diameter, acute at the apex and slightly notched at the base; spikes 7-10 or more in an umbel-like cluster.

Standley (1928) states that in Panama the leaves are rubbed on the body as protection against ticks and that the plant rarely grows where ticks are abundant.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1637; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3059.

Range: American tropics.

2. PIPER Linnæus

Leaves sessile, at least the terminal and uppermost ones.....1. *P. demeraranum*

Leaves not sessile:

Leaves not oblique at the base, or scarcely so.....2. *P. glabrescens*

Leaves decidedly oblique at the base:

Leaves mostly truncate at the base, obovate.....3. *P. Grahami*

Leaves not truncate at the base, ovate:

Leaves leathery, veins deep-set.....4. *P. Hostmannianum*

Leaves not leathery, thin, veins not deep-set.....5. *P. geniculatum*

1. **Piper demeraranum** (Miquel) C. DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 16¹: 298. 1869.

Artanthe demerarana Miquel, *London Journal of Botany* 4: 464. 1845.

A shrub; leaves obovate, broadly elliptic, acuminate, sessile or short-petioled, 15-20 cm. long, 5-8 cm. broad; spikes short, thick, opposite the leaves.

Vicinity of Kartabo, July 18, 1924, *Graham* 282.

Range: Guianas and Brazil.

2. **Piper glabrescens** (Miquel) C. DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 16¹: 271. 1869.

Artanthe glabrescens Miquel, *London Journal of Botany* 4: 461. 1845.

A shrub 1-2 m. high; leaves ovate-elliptic, sharply acuminate, tapering slightly at the base, 15-20 cm. long, 7-10 cm. broad; spikes stiff, thick, 4-5 cm. long.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1932.

Range: Guianas.

3. **Piper Grahami** Trelease, *Bulletin of the Torrey Botanical Club* 60: 477. 1933.

A shrub 1.5 m. (5 feet) tall, in aspect of foliage resembling *P. dilatatum*; axes, petioles and nerves beneath more or less persistently crisp-pubescent; upper internodes slender, rather quickly elongating; leaves subrhombically elliptic-obovate, acuminate, the narrowed base rounded, somewhat shorter on one side, 7-8 x 15-18 cm., pinnately nerved from the lower half, the nerves 5 x 2, with connecting cross-veins, drying thin and firm; petiole 8 or 10 x 2 mm., blunt; peduncle scarcely 5 mm. long; bracts rounded-subpeltate.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 227 (TYPE).

Range: Known only from the type locality.

4. **Piper Hostmannianum** C. DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 16¹: 287. 1869.

A shrub 2-3 m. high; leaves thick, lanceolate to ovate, 10-20 cm. long, 2-10 cm. broad, oblique at the base, acute to acuminate at the apex; spikes slender, 6 cm. long or more.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2622.

Range: American tropics.

5. **Piper geniculatum** Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 15. 1788.

Piper arboreum forma *geniculata* Fawcett and Rendle, *Flora of Jamaica* 3: 23. 1914.

A shrub with swollen nodes; leaves ovate-elliptic to oblong-elliptic, very oblique at the base, sharply acuminate, 10-40 cm. long, 5-14 cm. broad; spikes slender, shorter than the leaves; fruit a small berry, somewhat angled.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2899.

Range: West Indies and the Guianas.

3. PEPEROMIA Ruiz and Pavon

Leaves thin, pellucid, cordate.....1. *P. pellucida*

Leaves leathery, not cordate:

Leaves ovate, acuminate at the apex, acute at the base.....2. *P. macrostachya*

Leaves obovate, obtuse at the apex, gradually narrowing into the petiole at the base.....3. *P. magnoliaefolia*

1. **Peperomia pellucida** (Linnæus) Kunth, in Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 1: 64. 1815.

Piper pellucidum Linnæus, *Species Plantarum* 30. 1753.

A small, glabrous, fleshy, branched terrestrial annual; leaves thin, slender-petioled and broadly ovate, about 2 cm. long and as broad; flowers in short, slender spikes.

Matope, Cuyuni River, July 24, 1924, *Graham* 345.

Range: West Indies and Mexico to the Andes; introduced as a weed in the African tropics.

2. **Peperomia macrostachya** A. Dietrich, in Linnæus, *Species Plantarum* ed. 6. 1: 149. 1831.

A fleshy succulent herb; leaves thick, lanceolate-elliptic, 3-6 cm. long, 1-3 cm. broad, tapering at both ends; spike very slender, much longer than the leaves.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2909.

Range: Guianas.

3. ***Peperomia magnoliæfolia*** (Jacquin) A. Dietrich, in Linnæus, *Species Plantarum* ed. 6. 1: 153. 1831.

Piper magnoliæfolium Jacquin, *Collectanea ad Botanicum* 3:210. 1789.

A glabrous, succulent herb; leaves spatulate, 3-12 cm. long, tapering into a subsessile base; spike slender, exceeding the leaves in length.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2016.

Range: American tropics.

33. ULMACEÆ. Elm Family

1. TREMA Loureiro

1. ***Trema micrantha*** (Linnæus) Blume, *Museum Botanicum Lugduno-Batavum* 2: 58. 1853.

Rhamnus micranthus Linnæus, *Systema Naturæ* ed. 10. 937. 1759.

Celtis micrantha Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 53. 1788.

A small tree with rough pubescence; leaves alternate, short-petioled, oblong-ovate, acuminate, obliquely cordate at the base, finely crenate, pale beneath; flowers small, green, in dense, axillary clusters; fruit a very small red drupe, fleshy.

A tough fiber is made from the bark of this plant.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1884; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2898.

Range: American tropics.

34. MORACEÆ. Mulberry Family

Leaves deeply lobed..... 1. *POUROUMA*

Leaves not deeply lobed, entire or toothed:

Flowers borne on the inner surface of a globose or oblong, hollow receptacle, this with a small opening at the apex; inflorescence in this species of nearly sessile flowers clustered in the axils of the leaves or on the stem.... 2. *FICUS*

Flowers variously arranged but never on the inside of a receptacle; inflorescence in this species a terminal or axillary panicle..... 3. *COUSSAPOA*

1. POUROUMA Aublet

1. **Pourouma acutiflora** Trécul, Annales des Sciences Naturelles III.

8: 105. 1847.

SANDPAPER TREE

A tree; leaves alternate, large, deeply 3-5 cleft, cordate at the base, long-petioled, the margin entire or nearly so, the surface extremely rough; flowers diœcious, the male in cymose heads, the female usually single; fruit a drupe.

The rough leaves are reported to be used for sandpaper, and may well serve for such a purpose.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1657.

Range: Northern South America.

2. FICUS Linnæus

1. **Ficus Gleasoni** Standley, in Kribs, Tropical Woods 13: 34. 1928.

A shrub or tree 3-6 m. high or more; leaves alternate, thick, leathery, ovate-lanceolate, 10-18 cm. long, 2-5 cm. broad, acuminate at the apex; flowers in axillary clusters; fruit about 7 mm. in diameter, globose.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2639.

Range: British Guiana.

3. COUSSAPOA Aublet

1. **Coussapoa microcephala** Trécul, Annales des Sciences Naturelles

III. 8: 96. 1847.

A tree 4-10 m. high; leaves alternate, very thick, long-petioled, ovate, with milky juice; flowers yellow, diœcious, in globose heads, the male clusters few-flowered, often paniculate, the female on shorter peduncles; fruit mulberry-like.

This genus is characterized by small trees which are epiphytic upon other trees, especially upon *Ficus*.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1577; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2636.

Range: Guianas.

Artocarpus incisa Linnæus, the Breadfruit, a native of the East Indies, is cultivated throughout the colony as it is in every tropical

country. It is a large tree 10 m. or more in height with 3-9-lobed leaves sometimes a meter in diameter. The fruit is a large fleshy mass (syncarp) formed of the aggregated flowers, about 15 cm. in diameter, often seedless, generally eaten cooked as a vegetable rather than raw as a fruit.

Brosimum Aubletii Poeppig and Endlicher, the Letterwood, Snake-wood or Burokoro, is listed by Zon and Sparhawk (1923) as a timber tree of the colony. It has very hard, dark brown beautifully marked wood, which is very heavy and used for inlaying, cabinet work, turnery and canes. Tibicushi or Bastard Letterwood is listed as a closely related species.

Cecropia angulata Bailey, the Trumpet Tree, is a tree with peltate leaves common at Kartabo, according to Bailey (1922a) who has studied it there as an ant-plant. He states that the hollow stems of the plant are inhabited by four distinct species of *Azteca* ants: *A. constructor* Emery, a black species colonized in a majority of the plants; *A. alfaroi* Emery, a yellowish species found in a considerable number of the plants; *A. instabilis* F. Smith; and *A. trigona* subspecies *mediops* Forel, the two latter in occasional plants. The coccids *Pseudococcus rotundus* Morrison, *Akermes quinquepori* Newstead and *Pseudococcus bromeliae* Bouché are associated with *Azteca*, especially *P. rotundus*.

Cecropia sciadophylla Martius (var. **decurrens** E. H. Snethlage) is also listed by Bailey (1922a) as a non-myrmecophytic species from the Kartabo region. It lacks the developed trichilium and numerous food bodies so characteristic of the ant-inhabited *C. angulata*. Leaves of the trees of this genus are reported to furnish the sole food of the sloth.

35. PROTEACEÆ. Protea Family

1. ANDRIAPETALUM Pohl

1. **Andriapetalum cayennense** Klotzsch, ex Meissner, in Martius, Flora Brasiliensis 5¹: 78. 1885.

A tree 3 m. high or more; leaves leathery, oblanceolate, whorled in 4's, acuminate, 10-30 cm. long, 3-12 cm. broad, sessile or short-petioled; flowers on spreading pedicels arranged in spikes up to 30 cm. long.

Graham 172 was a little more than 3 m. high and was found growing in the water along the river shore.

Vicinity of Kartabo, July 5, 1924, *Graham 172*; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2738*.

Range: Brazil and the Guianas.

36. OLACACEÆ. Ximenia Family

1. HEISTERIA Jacquin

1. **Heisteria cauliflora** Smith, in Rees, The New Encyclopedia 17: 1819.

Rhaptostylum cauliflorum O. Kuntze, Revisio Generum Plantarum 1: 112. 1891.

A tree 4 m. high or more; leaves alternate, oblong, acute, 20-30 cm. long, 5-8 cm. broad; flowers large, up to 5 cm. in diameter.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1662*.

Range: Guianas.

37. LORANTHACEÆ. Mistletoe Family

1. PHTHIRUSA Martius

Flower spikes simple, brown-furfuraceous; leaves oblong or oblong-ovate, obtuse.

1. *P. pyrifolia*

Flower spikes branched, glabrous; leaves broadly ovate, acute or acuminate.

2. *P. theobroma*

1. **Phthirusa pyrifolia** (Humbolt, Bonpland, and Kunth) Eichler, in Martius, Flora Brasiliensis 5²: 63. 1868.

Loranthus pyrifolius Humbolt, Bonpland, and Kunth, Nova Genera et Species Plantarum 3: 441. 1820.

Passowia pirifolia van Tieghem, Bulletin de la Société Botanique de France 42: 172. 1895.

A clump-forming shrub or climber; leaves opposite, ovate-orbicular, acuminate, less than 6 cm. long; flowers in irregular panicles; fruit a fleshy berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3030*.

Range: Northern South America and Panama.

2. *Phthirusa theobromæ* (Willdenow) Eichler, in Martius, Flora Brasiliensis 5²: 56. 1868.

Loranthus theobromæ Willdenow, in Schultes filius, Systema Vegetabilium 7: 132. 1829.

Passovia theobromæ van Tieghem, Bulletin de la Société Botanique de France 42: 172. 1895.

A clump-forming shrub or vine; leaves opposite, ovate-tapering to acuminate, up to 10 cm. long; flowers white or yellow, in loose panicles; fruit a fleshy red berry.

Vicinity of Kartabo, July 5, 1924, *Graham* 152; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1598.

Range: Northern South America and Panama.

38. POLYGONACEÆ. Buckwheat Family

1. COCCOLOBA Linnæus

Leaves brown-tomentose beneath, broadly ovate, 15 cm. or more in length.

1. *C. excelsa*

Leaves glabrous beneath, lanceolate-ovate, less than 15 cm. in length.

2. *C. guianensis*

1. *Coccoloba excelsa* Benthams, London Journal of Botany 4: 624. 1845.

A sturdy shrub or small tree; leaves alternate, thick, ovate, dense brown-tomentose beneath; flowers axillary in spikes; fruit a berry.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2737.

Range: American tropics.

2. *Coccoloba guianensis* Meissner, Linnæa 21: 254. 1848.

A low tree; leaves alternate, smooth, leathery, ovate-cordate to oblong-lanceolate, 10-15 cm. long, 5-8 cm. broad; flowers in spike-like racemes, terminal or axillary; fruit a small, striated berry.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2668.

Range: Trinidad and the Guianas.

Coccoloba uvifera (Linnæus) Jacquin, the Seaside Grape, is not listed in recent reports, and there are no specimens in our herbarium from British Guiana, but it is widely distributed in tropical America

along sea beaches and should be seen along the coast and low rivers in the colony. It is a shrub or small tree with thick, stiff, orbicular, nearly sessile leaves 10-20 cm. broad.

Antigonon leptopus Hooker and Arnott, the Coral Vine or Red Coralita, is reported by Hitchcock (1921) along the coast. It is a native of western Mexico, with deltoid-cordate, petioled leaves, and climbs by tendrils which are at the ends of the racemes of bright pink flowers. There is also a white variety.

Triplaris surinamensis Chamisso, the Long-john, is a tree which grows near Kartabo, according to Bailey (1922a), and is one of the ant-plants of the region. It is a tree with alternate, ovate leaves and sessile flowers in long spikes which are sometimes branched.

39. BATIDACEÆ. Saltwort Family

Batis maritima Linnæus, the Saltwort, is reported by Hitchcock (1921) on the sand flats at Georgetown. It is a glabrous shrub 1m. high or less with stems spreading, prostrate or ascending, the branches nearly erect, angular; leaves 1-2.5 cm. long, acute; spikes 5-10 mm. long, the staminate sessile, the pistillate short-peduncled; fruit 1-2 cm. long, drooping. It ranges from southeastern United States throughout tropical America.

40. PHYTOLACCACEÆ. Pokeweed Family

1. MICROTEA Swartz

1. **Microtea debilis** Swartz, Prodrumus Descriptionum Vegetabilium Indiæ Occidentalis 53. 1788.

An annual herb about 1 m. high or less; leaves alternate, thin, ovate, tapering toward the petiole; flowers pinkish-white, in lateral spikes.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2480.

Range: West Indies and northern South America.

41. NYCTAGINACEÆ. Four-o'clock Family

Hitchcock (1921) lists three species of **Bougainvillea** as cultivated vines in Georgetown and along the coast. They are: **B. glabra** Choisy, with pink bracts; **B. glabra** var. **Sanderiana** Hort., which has purple bracts; and **B. spectabilis** var. **lateritia** Lemaire, which has terra

cotta bracts. These magnificent vines are natives of Brazil, and conspicuous throughout the American tropics. The flowers themselves are small, borne in groups of three, each with a large bract which is showy and forms the attractive part of the inflorescence.

42. AIZOACEÆ. Carpet-weed Family

Sesuvium portulacastrum Linnæus, the Sea Purslane, is reported by Hitchcock (1921) on the sand flats near Georgetown. It is a fleshy glabrous perennial with prostrate branches forming large clumps. The leaves are oblanceolate-oblong, 1-5 cm. long, acute, the bases clasping; the purplish flowers are solitary in the axils of the leaves; the capsule is cone-shaped, 8-10 mm. long. It occurs in southeastern United States, tropical America and the old world tropics.

43. NYMPHÆACEÆ. Water Lily Family

Carpels not borne in a fleshy receptacle; leaves cauline, of two kinds, the submerged opposite or whorled, dissected into capillary segments, the floating leaves when present few, peltate; sepals 3; petals 3. 1. *CABOMBA*
Carpels immersed in a fleshy receptacle; leaves arising from a large horizontal rootstock, floating or immersed, the blades broadly elliptic to suborbicular; sepals 4; petals numerous. 2. *NYMPHÆA*

1. *CABOMBA* Aublet

1. ***Cabomba aquatica*** Aublet, *Histoire des Plantes de la Guiane Française* 1: 321. 1775.

A submerged or floating aquatic plant; leaves floating, 1-2 cm. in diameter, peltate, elliptic, those submerged finely dissected; flowers yellow, long-peduncled; fruit indehiscent.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1954.

Range: Mexico to northern South America.

2. *NYMPHÆA* J. E. Smith

1. ***Nymphæa amazonum*** Martius and Zuccarini, *Abhandlungen der Mathematisch-physikalischen Classe der Akademie zu München* 1: 363. 1832. WATER LILY

Nymphæa Rudgeana var. *amazonum* Grisebach, *Flora of the British West Indian Islands* 12. 1859.

Castalia amazonum Britton and Wilson, *Scientific Survey of Porto Rico and the Virgin Islands* 5¹: 305. 1923.

An aquatic herb with horizontal perennial rootstocks; leaves floating, suborbicular, 9-17 cm. broad, entire, petioles often with a ring of hairs at the top; flowers white, floating, nocturnal, 8-14 cm. in diameter; sepals elliptic to ovate-elliptic; fruit subspherical, about 4 cm. in diameter.

Vicinity of Bartica, on the Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2014.

Range: West Indies and northern South America.

Nymphæa ampla DeCandolle, another white-flowered water lily, is reported by British Empire Exhibition (1924) from inland lakes in the colony.

Nelumbium speciosum Willdenow, the Indian Lotus, may be observed in trenches and canals at Georgetown and at the Penal Settlement across the river from Kartabo. This genus differs from *Nymphæa* in having distinct carpels imbedded in the receptacle with a single ovule in each, and peltate leaves which stand high above the water. It is native to the Orient but not of Egypt, the true Egyptian Lotus, which name is often falsely applied to this species, being a *Nymphæa*. A synonym for this species is *Nelumbo nucifera* Gaertner.

Victoria regia Lindley, Royal Lily, (*See* Plate III) occurs native on the waters of the Demerara River, and may now be seen in other parts of the region. It is cultivated in the Georgetown Botanic Garden. Although observed and collected before in other parts of South America, it remained for Robert H. Schomburgk (brother of Richard) to send collections to Europe from the Demerara River in 1837, upon which Lindley based the first scientific description, giving the plant the name which it now holds. Its large white and pink flowers and great orbicular leaves, sometimes more than 2 m. in diameter, cannot be confused with any others in the region.

44. MENISPERMACEÆ. Moonseed Family

Leaves more than 12 cm. long, gradually acuminate to attenuate at the apex; cotyledons lying one upon the other.....1. *ABUTA*
 Leaves less than 12 cm. long, acute or abruptly acuminate at the apex; cotyledons not lying one upon the other.....2. *ANOMOSPERMUM*

1. *ABUTA* Aublet

1. **Abuta guyanensis** Eichler, in Martius, *Flora Brasiliensis* 13¹: 181. 1864.

A woody vine; leaves alternate, ovate-acuminate, 10-20 cm. long, 5-10 cm. broad, long-petioled, leathery; flowers purple, in axillary racemes.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1646.

Range: Guianas.

2. ANOMOSPERMUM Miers

1. **Anomospermum Schomburgkii** Miers, *Annals and Magazine of Natural History* II. 7: 102. 1851; III. 14: 103. 1864.

A woody vine; leaves alternate, shiny, leathery, ovate, bluntly acuminate, with a short, thick petiole; flowers white to red, in long, loose, leafy, spike-like racemes; fruit ellipsoid, hard, 2-3 cm. long.

According to Cheney (1931) the roots are used in making an arrow poison, which is also true of **A. lucidum** Miers, a native of British Guiana.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2682.

Range: Guianas.

45. ANONACEÆ. Custard Apple Family

1. CYMBOPETALUM Bentham

1. **Cymbopetalum brasiliense** (Vellozo) Bentham, *Journal of the Linnæan Society* 5: 69. 1861.

Uvaria brasiliensis Vellozo, *Floræ Fluminensis* 238. 1825; *Floræ Fluminensis Icones* 5: pl. 122. 1827.

A small tree; leaves alternate, oblong-elliptic, acuminate, nearly sessile, 20-30 cm. long, 5-10 cm. broad; flowers aromatic, in dense umbels; fruit pod-like, constricted, with about 5 seeds.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2002.

Range: Northern South America.

The genus **Anona**, Custard Apples, furnishes many of the fleshy fruits of the tropics, among which are the following: **A. muricata** Linnæus, the Soursop, has a mango-like flavor and is native to tropical America, the large, heart-shaped, dark green fleshy fruit sometimes weighing 5 pounds and covered with recurved, fleshy spines; **A. purpurea** Möcino and Sessé, the Negro Head, native to Mexico and Panama, has a large fruit covered with pyramidal protuber-

ances; **A. diversifolia** Safford, the Ilama, native to Mexico and Salvador, has a fruit shaped like a pineapple cheese; **A. cherimola** Miller, the Cherimoya, with a variable fruit, sometimes with protuberances, sometimes with U-shaped areoles each with a small tubercle, is a native of Peru and the Andes; **A. longiflora** Watson, the Wild Cherimoya of Jalisco, has a conoid fruit covered with reticulated areoles, and is native to Jalisco, Mexico; **A. reticulata**, the common Custard Apple, has a smooth fruit with the surface divided into rhombic or hexagonal areoles by impressed lines, and is native to tropical America, but now cultivated and spontaneous in many parts of the tropics; and **A. squamosa** Linnæus, the Sugar Apple or Sweetsop, which has tuberculate fruit, is native to tropical America and now widely cultivated.

Rollinia is a genus of shrubs or trees of which many species have been described from the Guianas. It is undoubtedly represented in the rain-forest at Kartabo although no specimens are in the Carnegie Museum collections.

46. MYRISTICACEÆ. Nutmeg Family

1. MYRISTICA Linnæus

Leaves truncate or abruptly contracted at the base, 2-5 cm. broad.

1. *M. surinamensis*

Leaves cordate at the base, 5-12 cm. broad..... 2. *M. sebifera*

1. **Myristica surinamensis** Roland, from Rottboel, in Acta Litteraria Universitatis Hafniensis 1: 281. 1778. WILD NUTMEG, DALLI

A tree 10-20 m. high; leaves alternate, linear-oblong, glabrate, rusty beneath, usually cuspidate, 15-25 cm. long, 2-5 cm. broad, short-petioled and truncate at the base; flowers yellow, in axillary panicles.

The wood is soft, gray, coarse-grained and is used for interior work. The trunk has rudimentary stilt buttresses at the base.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2023.

Range: West Indies and the Guianas.

2. **Myristica sebifera** Swartz, Prodomus Descriptionum Vegetabilium Indiæ Occidentalis 96. 1788.

A tree 4 m. high; leaves alternate, oblong, rusty-tomentose beneath, 10-25 cm. long, 4-12 cm. broad, cordate at the base, rounded to acute or acuminate at the apex; flowers in axillary panicles.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1994*; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 2001*.

Range: American tropics.

Myristica fragrans Houttuyn, the Nutmeg of commerce, native to the East Indies, is cultivated and naturalized in the West Indies, especially Grenada. Occasional plants may be seen in the coastal area.

47. MONIMIACEÆ. Monimia Family

1. SIPARUNA Aublet

1. **Siparuna guianensis** Aublet, *Histoire des Plantes de la Guiane Françoise* 2: 865. 1775.

A shrub 3-4 m. high; leaves opposite, oblong-elliptic, mucronate; flowers in contracted, axillary cymes.

Vicinity of Kartabo, July 5, 1924, *Graham 156*; vicinity of Kartabo, July 18, 1924, *Graham 276*; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1580*; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1967*.

Range: Guianas.

48. LAURACEÆ. Laurel Family

Leaves abruptly acuminate to mucronate at the apex; anther cells in pairs, one above the other.....1. *OCOTEA*

Leaves gradually acuminate to attenuate at the apex; anther cells all inserted at nearly the same height.....2. *NECTANDRA*

1. OCOTEA Aublet

Leaves ovate-elliptic to orbicular, mucronate with a long tip, generally less than 15 cm. long.....1. *O. caudata*

Leaves ovate-lanceolate to oblong, abruptly acuminate, generally more than 15 cm. long.....2. *O. Martiniana*

1. **Ocotea caudata** (Nees) Mez, *Jahrbuch des Botanischen Gartens, Berlin* 4: 378. 1889.

Oreodaphne caudata Nees, *Linnæa* 21: 519. 1848.

A tree or shrub; leaves alternate, ovate-elliptic to orbicular, mucronate, 6-15 cm. long, 3-8 cm. broad; flowers small, in short axillary panicles; fruit a small berry, partly enclosed in the enlarged perianth tube.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1977.

Range: British Guiana.

2. **Ocotea Martiniana** (Nees) Mez, Jahrbuch des Botanischen Gartens, Berlin 5: 345. 1889.

Oreodaphne Martiniana Nees, Systema Laurinarum 415. 1836.

A tree or shrub; leaves alternate, ovate-lanceolate to oblong, acuminate, 12-25 cm. long, 6-10 cm. broad; flowers small, in short axillary panicles; fruit a berry, partly enclosed in the enlarged perianth tube.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2929.

Range: British Guiana.

2. NECTANDRA Roland

1. **Nectandra Pichurim** (Humbolt, Bonpland, and Kunth) Mez, Jahrbuch des Botanischen Gartens, Berlin 5: 449. 1889.

KERITI SILVERBALLI

Ocotea Pichurim Humbolt, Bonpland, and Kunth, Nova Genera et Species Plantarum 2: 166. 1817.

A shrub or tree; leaves alternate, lanceolate-elliptic, broadest below the middle, 10-15 cm. long, 2-5 cm. broad; flowers in terminal, axillary racemes.

The wood is fairly soft, brown, coarse-grained and used for interior construction and boat building.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1894.

Range: Venezuela and the Guianas.

Nectandra Rodiaei Schomburgk, the Greenheart, is listed by Zon and Sparhawk (1923) as one of the British Guiana's most valuable timber trees, with silvery, scaly bark and strong, straight-grained wood which is very durable in soil or water. It resists termites and teredo and is much used for docks, piles, ship building and general construction. Several other species of the genus are also valuable as timber, among which Zon and Sparhawk list **Nectandra Pisi** Miquel, the Yellow Silverballi, and three undetermined species known as Determa, Brown Silverballi, and Silverballi or Ciruaballi respectively.

49. HERNANDIACEÆ.

I. SPARATTANTHELIUM Martius

1. **Sparattanthelium botocudorum** Martius, Denkschriften Botanische Gesellschaft in Regensburg 3: 302. 1841.

A shrub, sometimes climbing, or small tree; leaves alternate, ovate to elliptic, 3-nerved, acute at the apex, abrupt at the base, 10-15 cm. long, 3-6 cm. broad, tomentose below when young; flowers small, in loose terminal panicles.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2732.

Range: Brazil and the Guianas.

50. CRUCIFERÆ. Mustard Family

I. SINAPIS Linnæus

1. **Sinapis arvensis** Linnæus, Species Plantarum 668. 1753.

CHARLOCK

Brassica sinapistrum Boissier, Voyage Botanique dans le Midi de l'Espagne 2: 39. 1839-45.

Brassica arvensis Britton, Sterns, and Poggenburg, Preliminary Catalogue of Anthophyta and Pteridophyta 1888.

An erect herb 3-6 dm. high, hispid or glabrate; leaves alternate, oblong to elliptic, dentate to subpinnatifid; flowers yellow, 1-2 cm. broad; pods glabrous, spreading or ascending, constricted between the seeds, tipped with an angled, conic beak which is often 1-seeded, valves nerved.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1581.

Range: Native to Europe, naturalized in the West Indies and North and South America; widely distributed as a weed.

51. DROSERACEÆ. Sundew Family

Drosera communis St. Hilaire is reported by British Empire Exhibition (1924) to carpet the ground in the savannahs above Kaiteur Falls and it may occur within the Kartabo region.

52. PODOSTEMONACEÆ. Riverweed Family

Mourera fluviatilis Aublet is reported by British Empire Exhibition (1924) as occurring in strong currents on rocks submerged at high tide. After the wet season, when the river falls, its pink flowers appear above the water. This plant may well occur in the rapids of the rivers above Kartabo.

53. CRASSULACEÆ. Orpine Family

Bryophyllum calycinum Salisbury, the Tree of Life, is reported by Beebe (1925) as thriving in the Kartabo region. It is native to the tropics of both hemispheres and gets its common name from the capacity of the fleshy, crenate leaves to regenerate complete plants on their margins.

54. ROSACEÆ. Rose Family

Corolla radially symmetrical or nearly so; plants glabrous or tomentose, not pilose:
Calyx funnelform, campanulate; leaves spatulate-ovate, emarginate.

1. *CHRYSOBALANUS*

Calyx hemispherical or jug-shaped; leaves lanceolate-ovate to oblong-ovate.

2. *LICANIA*

Corolla irregular; plants pilose with spreading hairs. 3. *HIRTELLA*

1. *CHRYSOBALANUS* Linnæus1. **Chrysobalanus Icaco** Linnæus, Species Plantarum 513. 1753.

COCO PLUM, PIGEON PLUM

A shrub; leaves alternate, small, wedge-shaped, emarginate; flowers small, white, petals 5, stamens numerous; fruit a drupe 2-4 cm. long, white or purple.

The edible but insipid fruit is eaten or made into dulces; the seeds are agreeable in flavor and rich in oil.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2015.

Range: African and American tropics.

2. *LICANIA* Aublet

Leaves less than 10 cm. long; flowers in simple racemes 6-10 cm. long.

1. *L. incana*

Leaves more than 10 cm. long; flowers in loose, compound racemes 15 cm. long or longer. 2. *L. micrantha*

1. **Licania incana** Aublet, Histoire des Plantes de la Guiane Française

1: 119. pl. 45. 1775.

A low woody shrub; leaves alternate, ovate, abrupt at the base, acuminate at the apex, 5-10 cm. long, 2-4 cm. broad, often brown velvety tomentose beneath; flowers in terminal or axillary spike-like racemes about as long as the leaves; fruit a drupe, small, hard, about 1.5 cm. long.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2715.

Range: Guianas.

2. **Licania micrantha** Miquel, *Stirpes Surinamenses Selectæ* 29. 1850.

A woody shrub or small tree; leaves alternate, leathery, oblong-elliptic, 10-15 cm. long, 5-8 cm. broad; flowers white, in loose compound racemes; fruit a drupe.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2739; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1670.

Range: Guianas.

3. **HIRTELLA** Linnæus1. **Hirtella paniculata** Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 51. 1788.

Hirtella hirsuta Lamarck, *Illustrationes des Genres* 2: 114. 1793.

A pilose shrub; leaves alternate, nearly sessile, oblong-ovate, acute at the apex, 5-10 cm. long, 3-5 cm. broad; flowers in axillary racemes, petals 5, deciduous, stamens 3-10.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1585.

Range: Guianas.

55. **CONNARACEÆ**. Connarus Family1. **ROUREA** Aublet1. **Rourea glabra** Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 7: 41. 1825.

A trailing shrub or small tree; leaves alternate, compound; leaflets 3-5 or more, oblong-elliptic, leathery, 4-11 cm. long, 2-5 cm. broad; flowers white or yellow, in short panicles; fruit a red capsule.

The shiny, dark brown seeds are very poisonous, are used in destroying noxious animals and have been reported for criminal poisoning of human beings. The tough stems are said to be used for cordage.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2641; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2719.

Range: Mexico, West Indies and northern South America.

Connarus guianensis Lambert, the Zebrawood or Haiawa-balli, occurs in the region according to Zon and Sparhawk (1923). It is a fairly large tree with wood which is substituted for mahogany in furniture and cabinet work.

56. MIMOSACEÆ. Mimosa Family

Sepals valvate in the bud:

Stamens as many, or twice as many, as the petals.....1. *MIMOSA*

Stamens numerous, always more than 10:

Stamens less than twice the length of the corolla tube; pods broad, indehiscent.

2. *INGA*

Stamens more than twice the length of the corolla tube; pods narrow, dehiscent.....3. *PITHECELLOBIUM*

Sepals not valvate in the bud, slightly imbricated.....4. *PENTACLETHRA*

1. *MIMOSA* Linnaeus

1. ***Mimosa myriadena*** Benthams, in Martius, Flora Brasiliensis 15²:
344. 1876. SENSITIVE PLANT

A shrub, sometimes climbing, woody, armed with short, recurved prickles; leaves alternate, bipinnate; leaflets 10-20, 20-30-parted, 3.5 cm. long, 1 cm. broad; flowers sessile, in numerous slender, white spikes.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2623.

Range: Brazil and the Guianas.

Mimosa guianensis Aublet, the Hubu-balli or Hou-boo-balli, is reported by Zon and Sparhawk (1923) as a timber tree of the colony. It has figured brown wood which is durable in water and used for boat building, cabinet work and furniture.

Mimosa polydactyla Humbolt and Bonpland, is reported by Beebe (1925) as a sensitive plant at Kartabo which wilts at a touch.

2. *INGA* Scopoli

Petiole winged.....1. *I. ingoides*

Petiole not winged:

Leaves pubescent, especially on the veins beneath:

Tall trees, up to 30 m. high; leaflets oblong-lanceolate.....2. *I. Ruiziana*

Shrubs or trees 4-5 m. high; leaflets ovate to elliptic-lanceolate:

Corolla 8-10 mm. long.....3. *I. nobilis*

Corolla 20-25 mm. long.....4. *I. Thibaudiana*

Leaves not pubescent, glabrous.....5. *I. heterophylla*

1. ***Inga ingoides*** Willdenow, Species Plantarum 4: 1019. 1806.

A tree; leaves alternate, rusty-tomentose, even-pinnate; leaflets 8-12, 8-12 cm. long, 1.5-3 cm. broad, elliptic, tapering at both ends;

petiole winged with conspicuous nectaries at the bases of the leaflets; inflorescence a few-flowered raceme; pod light brown, hairy, 4-parted, square and sickle-shaped.

The common name Warakusa is given to various species of the genus *Inga*.

Along Cuyuni River, near Camaria road, July 23, 1924, *Graham 326*.

Range: West Indies and the Guianas.

2. *Inga Ruiziana* G. Don, General History of the Dichlamydeous Plants 2: 391. 1832.

A tree about 25 m. high; leaves alternate, even-pinnate; leaflets in 4 pairs, oblong-lanceolate to elliptic, 8-20 cm. long, 3-8 cm. broad, smooth or puberulent above, brown tomentose beneath, especially on the veins, abruptly acuminate at the apex, obtuse at the base; flowers in compact spikes, calyx about 5 mm. long; pod flat, puberulent, 2.5 cm. broad.

Graham 184 is here referred to this species, although the flowers seem more compactly arranged than is typical.

Vicinity of Kartabo, July 8, 1924, *Graham 184*.

Range: Panama to Peru.

3. *Inga nobilis* Willdenow, Enumeratio Plantarum Horti Botanici Berolinensis 1047. 1809.

A tree 4 m. high; leaves alternate, even-pinnate; leaflets 6-10, 10-15 cm. long, 2-5 cm. broad, ovate-elliptic, tapering at both ends; flowers white, in long-stalked umbels; pod flat, 2.5 cm. broad, glabrate.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2629*.

Range: Brazil and the Guianas.

4. *Inga Thibaudiana* DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis 2: 434. 1825.

A tree; leaves alternate, even-pinnate; leaflets 8-14, glossy above, dull beneath, 4-16 cm. long, 3-8 cm. broad, ovate to elliptic, acuminate at the apex, conspicuous nectaries at the base of the leaflets; flowers white, in long, dense spikes; pods puberulent to glabrate, 2.5 cm. broad and up to 30 cm. long.

Between the Demerara and Berbice Rivers, Lat. 5° 50' N., July 15-19, 1922, *De La Cruz 1595*.

Range: Guianas.

5. *Inga heterophylla* Willdenow, *Species Plantarum* 4: 1020. 1806.

A tree 3-5 m. high; leaves glabrous, alternate, even-pinnate; leaflets 2-4, ovate-elliptic to lanceolate, 3-12 cm. long, 1.5-5 cm. broad, tapering at the base, acuminate to acute at the apex; flowers in terminal or axillary umbels; pods 8-10 cm. long, flat, margins thickened.

Graham 343 is probably this species although the pods are immature and there are no flowers.

Matope, Cuyuni River, July 24, 1924, *Graham* 343.

Range: Trinidad to the Guianas and Brazil.

3. *PITHECELLOBIUM* Martius¹¹

Leaves 2-pinnate; leaflets small, 30-50, 8-12 mm. long. 1. *P. adianthifolium*
Leaves 1-pinnate; leaflets large, 6-10, 2-8 cm. long:

Leaflets obovate to trapeziform. 2. *P. trapezifolium*
Leaflets ovate, acuminate. 3. *P. cauliflorum*

1. *Pithecellobium adianthifolium* Bentham, *London Journal of Botany* 3: 218. 1844.

A tree; leaves alternate, 2-pinnate; pinnae 12-18, leaflets 20-40 about 10 cm. long, 2.5 cm. broad; flowers large, white, in long-peduncled heads; pods flat, constricted.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1576; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3026.

Range: Guianas.

2. *Pithecellobium trapezifolium* Bentham, *London Journal of Botany* 2: 142. 1840.

A tree; leaves alternate, the terminal ones appearing opposite, even-pinnate; leaflets 4-8, glossy above, dull beneath, trapeziform, about 3 cm. long, 2.5 cm. broad; flowers sessile in peduncled heads or short rusty-pubescent spikes.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2718.

Range: American tropics.

¹¹According to Sprague, *Kew Bulletin* 1929: 243. 1929, Martius, in Schrank and Martius, Reg. Monac. 188. 1829, sine descr., originally employed this spelling, instead of *Pithecolobium* and other spellings subsequently used.

3. **Pithecellobium cauliflorum** Martius, Flora Brasiliensis 15²: 450. 1876.

A tree; leaves alternate, even-pinnate; leaflets 4-8, elliptic, acuminate, about 8 cm. long, 3 mm. broad; flowers pink, in sessile clusters.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1575.

Range: Brazil and the Guianas.

Pithecellobium latifolium Benthams, the Maibike, is reported by Beebe (1925) as a shrub of the clearings with rose colored flowers. It blooms in July at Kartabo and attracts great numbers of insects.

Pithecellobium Saman (Jacquin) Benthams is reported by Hitchcock (1921). It is the Saman or Rain Tree, the most conspicuous and one of the most magnificent and largest of the shade trees cultivated in Georgetown. It is a native of Central America and the West Indies. The leaves are often 4 dm. long, the pinnæ 2-6 pairs, the pinnules 2-8 pairs, 2-4 cm. long. The inflorescence is a many-flowered umbel and the pod is compressed, up to 20 cm. long.

4. PENTACLETHRA Benthams

1. **Pentaclethra macroloba** (Willdenow) O. Kuntze, Revisio Generum Plantarum 1: 201. 1891. TRYSEL

Acacia macroloba Willdenow, Species Plantarum 4: 1050. 1806.

A shrub; leaves alternate, feathery, bipinnate; leaflets 20-30, 5-10 cm. long, 1-2 cm. broad, divisions slender, 50-70 in number; flowers white, sessile, in sturdy racemes 25 cm. long.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1995; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2681.

Range: Guianas.

Pentaclethra filamentosa Benthams, another timber tree of the colony, listed by Zon and Sparhawk (1923), is known by the same name as the preceding species, Trysil, and is sometimes listed as Koroballi or Kuruballi. Hingston (1932) reports that the flowers of "trysil" are conspicuous on the roof of the forest.

57. CÆSALPINIACEÆ. Senna Family

Sepals in the bud entirely undivided or the segments above the receptacles growing out into a short lapped or toothed tube, at flowering splitting unequally or more or less distinctly appearing in split segments:

- Leaves not pinnate, simple or 2-lobed or parted from the base...1. *BAUHINIA*
Leaves pinnate, very seldom (then with 5 fertile stamens) simply parted.

2. *MORA*

Sepals already segmented in the bud or then free from the receptacle:

- Leaves entire or doubly pinnate.....3. *POINCIANA*

Leaves simply pinnate:

- Anthers more or less basally attached, dehiscent by terminal pores.. 4. *CASSIA*

Anthers distinctly dorsally attached, not dehiscent by terminal pores:

Ovary adherent to the back of the receptacle:

Bracts small:

- Leaves 1-divided, bifoliate.....5. *HYMENÆA*

- Leaves 2-many times divided, pinnate.....6. *TACHIGALIA*

- Bracts large.....7. *MACROLOBIUM*

- Ovary free at the base of the receptacle.....8. *CAMPSIANDRA*

1. *BAUHINIA* Linnæus

1. *Bauhinia Kunthiana* Vogel, Linnæa 13: 312. 1839.

A woody vine; leaves alternate, simple, broad, ovate-reniform, bright green above, brown-tomentose beneath; flowers large, pink, in long racemes, stamens 10 or less, calyx 5-lobed; pods linear to oblong.

Species of this genus are much used for bush rope.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2409; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2471; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2735.

Range: South America.

2. *MORA* Benth

1. *Mora excelsa* Benth, Transactions of the Linnæan Society 18: 210. pl. 16, 17. 1839. (See Plate IX). *MORA*

Dimorphandra Mora Benth and Hooker filius, Genera Plantarum 1: 588. 1865.

Dimorphandra excelsa Baillon, Histoire des Plantes 2: 167. 1870.

A tree 45 m. high; leaves alternate, even-pinnate; leaflets 6-10, oblong-elliptic, blunt, leathery, 10-15 cm. long, 3-5 cm. broad; flowers white, in elongate dense spikes 15-25 cm. long and compound at the base, petals 5, pod glabrous, up to 25 cm. long, about 6 cm. broad, containing 2 large seeds half as long and nearly as broad as the legume itself.

The trunk of the *Mora* is often buttressed at the base and the bark is ashy brown or light yellowish brown in color. The leaves, when young, are bright red, giving the tree the appearance of being in flower. This is one of the best known and most valuable woods of the colony. It is more durable than teak and is used in ship building, for piles, furniture, ties and paving. The wood is coarse-grained, dark reddish brown.

Vicinity of Kartabo, July 14, 1924, *Graham 249*; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1627*.

Range: Trinidad, eastern Venezuela and the Guianas.

Mora Gonggrijpii (Kleinhoonte) Sandwith, the *Morabukea*, is described by Sandwith (1932) as not so large as the *Mora* and with brick-red bark; it generally grows in areas free from flooding while the *Mora* prefers swampy localities. In addition to the bark it differs from *M. excelsa* in the leaflets which are generally 4 in number, laxly reticulate beneath instead of finely so, and the ovary is sessile or barely stipitate instead of distinctly stipitate as in *M. excelsa*.

3. POINCIANA Linnæus

1. *Poinciana pulcherrima* Linnæus, Species Plantarum 380. 1753.

Cæsalpinia pulcherrima Swartz, Observationes Botanicae 166. 1791.

A shrub or tree; leaves alternate, large, bipinnate; flowers yellow, showy, in large terminal pyramidal racemes, the stamens and pistil long exserted; pod 10-15 cm. long, compressed.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1939*.

Range: Cosmopolitan in the tropics.

Poinciana regia Bojer, the Flame Tree, a native of Madagascar, is cultivated in the colony and is conspicuous in Georgetown and some of the villages. It has bright scarlet flowers, long leaves with 10-20 pairs of pinnæ, and a pod sometimes nearly a meter in length.

4. CASSIA Linnæus

Leaflets large, 3-5.....1. *C. quinquangulata*
 Leaflets small, 24-48.....2. *C. multijuga*

1. **Cassia quinquangulata** L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 108. 1792.

A shrub or tree; leaves alternate, even-pinnate; leaflets large, 4-6, obliquely ovate-acuminate, 10-15 cm. long, 5-10 cm. broad; flowers large, yellow, in huge, terminal, compound panicles, petals 5, conspicuously veined, stamens 5-10.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1897; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2411.

Range: Tropical America.

2. **Cassia multijuga** L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 108. 1792. GUANA

A tall, white-barked tree; leaves alternate, even-pinnate; leaflets 20-60, oblong, about 2.5 cm. long, 8 mm. broad; flowers large, yellow, in a corymbiform, terminal panicle, petals 5, stamens 5-10; pod membranous, oblong-linear, straight, glabrous, marked with transverse lines, 15-20 cm. long, 1-2 cm. broad.

Beebe (1925) reports this species to be very abundant at Kartabo and states the height of flowering is reached during the first part of September.

Vicinity of Kartabo, July 5, 1924, *Graham* 173; vicinity of Bartica, Essequibo River, Lat. 6° 26' N., September 3-12, 1922, *De La Cruz* 1883.

Range: Guianas.

Cassia alata Linnæus, the Carrion Crow Bush, is reported by British Empire Exhibition (1924) along dry roads. It is a shrubby plant easily recognized by its broadly winged pods.

5. HYMENÆA Linnæus

1. **Hymenæa Courbaril** Linnæus, Species Plantarum 1192. 1753.

COURBARIL, SIMIRI, LOCUST

A high tree; leaves alternate, bifoliolate; leaflets leathery, polished, about 8 cm. long, 3.5 cm. broad, oblique, oblong-lanceolate; flowers white, pedicellate; pod indehiscent, smooth, filled with mealy pulp.

The Courbaril reaches a height of more than 30 m. in some localities and its hard and heavy, dark brown or orange wood is strong, tough, and fairly durable. It is used in carpentry and construction of all kinds. The copal of South America exudes from its trunk and this

gum often becomes buried in the soil about the roots to be later dug up by collectors. It is used in making varnish, in incense, and for medicinal purposes. It is said that the bark of this tree, removed in a single piece, is used by the Indians in making canoes which will hold 25 men.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1931*.

Range: Mexico to South America.

6. TACHIGALIA Aublet

1. **Tachigalia paniculata** Aublet, *Histoire des Plantes de la Guiane Française* 1: 372. pl. 143, f. 1. 1775.

A tree; leaves alternate, even-pinnate; leaflets oblong-elliptic, 15-20 cm. long, 5-7 cm. broad; flowers short-pedicellate, racemose; pod oblong to elongate, compressed, membranous.

In the petioles, which are remarkably swollen, Wheeler (1921a and 1921b) found more than 30 different species of insects. Of these Bailey (1923) states that 7 are definitely attached to *Tachigalia* as their host plant. Among these are the ants *Pseudomyrma damnosa* Wheeler, *P. maligna* Wheeler with its two varieties *cholericus* Wheeler and *crucians* Wheeler, *Azteca foveiceps* Wheeler, and two extraordinary colonial beetles to which Schwarz and Barber have assigned the names *Coccidotrophus socialis* and *Eunausibius wheeleri*. Most of those petioles which contain beetles also contain numerous coccids, *Pseudococcus bromeliæ* Boushé.

Vicinity of Kartabo, July 18, 1924, *Graham 287*.

Range: Guianas.

7. MACROLOBIUM Schreber

- | | |
|----------------------------|---------------------------|
| Leaflets 2, large..... | 1. <i>M. bifolium</i> |
| Leaflets 30-50, small..... | 2. <i>M. acaciæfolium</i> |

1. **Macrolobium bifolium** Persoon, *Synopsis Plantarum seu Enchiridium Botanicum* 1: 39. 1805.

Vouapa bifolia Aublet, *Histoire des Plantes de la Guiane Française* 1: 25. 1775.

Macrolobium Vouapa J. F. Gmelin, *Linnæi Systema Vegetabilium* ed. 13. 93. 1791.

A tree; leaves alternate, bifoliolate; leaflets oblique, oblong-ovate, acuminate, about 15 cm. long, 5 cm. broad; flowers white, in short, lateral spikes.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1658; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2643.

Range: American tropics.

2. **Macrobium acaciæfolium** Benthams, in Martius, Flora Brasilensis 15²: 224. 1870.

Vouapa acaciæfolia Baillon, Histoire des Plantes 2: 109. 1870.

A tree; leaves alternate, pinnate; leaflets 40-60, oblong, about 1.5 cm. long, .5 cm. broad; flowers white, in short, lateral spikes.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1925.

Range: American tropics.

8. CAMPSIANDRA Benthams

1. **Campsiandra comosa** Benthams, in Hooker, Journal of Botany 2: 93. 1840.

A tree; leaves alternate, pinnate; leaflets leathery, oblong to ovate-acuminate, 10-15 cm. long, 4-6 cm. broad; flowers yellow, in compound panicles.

Graham 251 was collected from a tree extending from the shore over the waters of the Mazaruni River.

Vicinity of Kartabo, July 14, 1924, *Graham* 251.

Range: Guianas.

Brownea latifolia Jacquin, the Rosa del Monte, is reported by British Empire Exhibition (1924) to occur in the North Western District. It is a native of Venezuela and is a low tree with abruptly pinnate leaves and large clusters of crimson flowers.

Copaifera pubiflora Benthams, the Purpleheart or Koruburelli, is one of the well-known timber trees of the colony with strong, hard wood which is much used for furniture and general construction. Beebe (1925) reports a specimen at Kartabo which showed 380 annual rings.

Eperua falcata Aublet, the Soft Wallaba, and **Eperua Jenmani** Oliver, the Ituri Wallaba, are of common occurrence in the rain-forest of the Kartabo region. In the former species the single petal is greenish white to rose, in the latter rhododendron-mauve. The Wallabas, whose leaves are reported to color the waters of the rivers

the dark brown which they assume, have large falcate fruits which hang pendent from twigs on cord-like stems. It has been estimated that 40 per cent of the trees on elevated quartz sand dunes in central and eastern British Guiana are Wallabas. The timber of *E. falcata* is the most valuable, being coarse-grained, dark red wood which is very durable in exposed situations, is extensively used for shingles, staves, building, furniture, fence posts and fuel and is much exported. The flowers of **Eperua Schomburgkiana** Benthham possess a single large, broad, conspicuous petal observed along creek margins where this species seems to be confined.

Peltogyne paniculata Benthham, the Saka, has wood similar to the Purpleheart, which it, also, is sometimes called. It is a tall tree with 2-foliate, leathery leaves, the leaflets falcate, 7-15 cm. long. The flowers are in a racemose, generally terminal inflorescence; the legume is oblique, rhomboid, plano-compressed, leathery.

Peltogyne pubescens Benthham is a tall tree of the forest, much resembling *P. paniculata*, but the leaves are much smaller, the panicles more downy, the flowers larger and the stamens much longer.

Swartzia tomentosa DeCandolle, the Wamara, Clubwood, or Brazilian Ebony, has close-grained, almost black wood which is very strong and used for oars, cabinet and inlay work.

58. PAPILIONACEÆ. Bean Family

a. Stamens free:

b. Style involute at the apex, stigma lateral, introrse. . . . 1. *LEPTOLOBIUM*

bb. Style not involute at the apex, incurved, stigma terminal.

2. *DIPLotropis*

aa. Stamens united below, or sometimes one free from the others:

b. Fruit consisting of several 1-seeded joints, rarely by abortion 1-seeded.

3. *DESMODIUM*

bb. Fruit not jointed:

c. Leaflets 5 or more:

d. Leaves even-pinnate. 4. *ABRUS*

dd. Leaves odd-pinnate:

e. Fruit drupaceous. 5. *ANDIRA*

ee. Fruit not drupaceous:

f. Leaflets opposite. 6. *DEGUELIA*

ff. Leaflets alternate:

g. Fruit coiled. 7. *DREPANOCARPUS*

gg. Fruit not coiled:

h. Pods not winged. 8. *DALBERGIA*

hh. Pods winged:

i. Wings surrounding the body of the fruit.

9. *PTEROCARPUS*

ii. Wing of the fruit basal or terminal. . . . 10. *MACHÆRIUM*

cc. Leaflets 3 or fewer:

d. Leaflet 1, or leaves digitately 3-foliolate:

e. Plants woody; leaflet 1; fruit compressed. 8. *DALBERGIA*

ee. Plants herbaceous; leaflets 1-3; fruit terete. . . . 11. *CROTALARIA*

dd. Leaflets 3, leaves pinnate:

e. Nodes of the inflorescence not swollen:

f. Flowers yellow, striped or tinged with red; pods impressed between the seeds; plants erect. 12. *CAJANUS*

ff. Flowers pink, purple, blue, or whitish; pods not impressed between the seeds; plants usually scandent:

g. Style bearded; plants sometimes woody or erect. 13. *CLITORIA*

gg. Style glabrous; herbaceous vines. 14. *CENTROSEMA*

ee. Nodes of the inflorescence more or less swollen:

f. Style glabrous, or pubescent at the base:

g. Vexillar stamen united with the others. 15. *DIOCLEA*

gg. Vexillar stamen free. 16. *CALOPOGONIUM*

ff. Style bearded on the inner side, at least above. 17. *PHASEOLUS*

1. LEPTOLOBIUM Vogel

1. **Leptolobium costulatum** Miquel, *Stirpes Surinamenses Selectæ* 17. 1850.

A tree; leaves opposite, odd-pinnate, leaflets usually 3-5, leathery, ovate, 6-8 cm. long, 2-4 cm. broad; flowers in much-branched, terminal racemes; legume narrow, compressed.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2662.

Range: Guianas.

2. DIPLLOTROPIS Benthham

1. **Diplotropis brachypetalum** Tulasne, *Archives du Muséum Nationale d'Histoire Naturelle, Paris* 4: 111. 1845. *ARAMATTA*

A shrub 5 m. high or more; leaves alternate, odd-pinnate; leaflets large, 10-25 cm. long, 5-15 cm. broad; flowers in compound racemes; pod large, 10 cm. long, ovoid-oblong.

The greenish or brownish figured wood is used for boats, houses and furniture. The plant is reputed poisonous.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2696.

Range: West Indies and the Guianas.

3. **DESMODIUM** Desvaux

Racemes short, dense.....1. *D. barbatum*
 Racemes long, loose.....2. *D. canum*

1. **Desmodium barbatum** Benth and Ærsted, Naturhistorisk Forening Videnskabelige Meddelelser, Kjobenhavn 1853: 18. 1853.

Hedysarum barbatum Linnæus, Systema Naturæ ed. 10. 1170. 1759.

Meibomia barbata O. Kuntze, Revisio Generum Plantarum 1: 195. 1891.

A more or less pubescent herb 1 m. high or less; leaves alternate, 3-foliolate; leaflets 1.5-3 cm. long, somewhat narrower, ovate-elliptic to oblong; flowers white or pink, in dense, corymbose, terminal racemes; pod of several 1-seeded joints.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1869; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2479; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2933.

Range: West Indies and tropical continental America.

2. **Desmodium canum** (J. F. Gmelin) Schinz and Thellung, Mémoires de la Société des Sciences Naturelles de Neuchâtel 5: 371. 1914.

Hedysarum canum J. F. Gmelin, in Linnæus, Systema Vegetabilium 2²: 1124. 1791.

Meibomia cana S. F. Blake, Botanical Gazette 78: 276. 1924.

An erect herb; leaves alternate, 3-foliolate; leaflets acute, 4-8 cm. long, often smaller, half as broad as long; flowers small, in long, terminal panicles; pod 2-3 cm. long, slender, with several 1-seeded joints.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 217.

Range: An abundant weed from Panama and the West Indies to northern South America.

4. **ABRUS** Linnæus

1. **Abrus precatorius** Linnæus, Systema Naturæ ed. 12. 472. 1767.
 CORAL BEAD, ROSARY PEA, JIQUIRITY SEED

Glycine abrus Linnæus, Species Plantarum 753. 1753.

Abrus Abrus W. F. Wight, Contributions from the United States National Herbarium 9: 171. 1905.

A climbing, twining shrub; leaves alternate, even-pinnate, 6-13 cm. long; leaflets 20-40, oblong, about 15 mm. long, 5 mm. broad; flowers

red to purple, rarely white, in short, crowded, many-flowered racemes; pod oblong, beaked, 2-3.5 cm. long.

The seeds are bright scarlet with a conspicuous black spot, are violently poisonous, and are used in making rosaries and ornamental beads.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1966.

Range: Tropical regions of both hemispheres.

5. ANDIRA Lamarck

1. **Andira amazonum** Martius, from Benthams, in *Annalen des Wiener Museums der Naturgeschichte* 2: 107. 1838.

A tree; leaves alternate, odd-pinnate; flowers purple, in terminal panicles, the calyx brown velvety; fruit globose to obovoid, indehiscent.

Vicinity of Kartabo, July 26, 1924, *Graham* 360.

Range: Brazil and the Guianas.

6. DERRIS Loureiro

1. **Derris guianensis** Benthams, *Journal of the Linnæan Society* 4: Suppl. 106. 1860; in Martius, *Flora Brasiliensis* 15¹: 288. 1862.

Deguelia scandens Aublet, *Histoire des Plantes de la Guiane Française* 2: 750. 1775.

A woody vine; leaves alternate, odd-pinnate; leaflets opposite, leathery, oblong-ovate, acuminate, 8-12 cm. long, 3-5 cm. broad; flowers in axillary racemes; pod 1-seeded, flat, and papery.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 2013.

Range: Brazil and the Guianas.

7. DREPANOCARPUS G. F. W. Meyer

1. **Drepanocarpus ferox** Martius, in Benthams, *Annalen des Wiener Museums der Naturgeschichte* 2: 96. 1838.

A tree 7 m. high or more; leaves alternate, odd-pinnate; leaflets thick, oblong to obovate, 2-5 cm. long, 1-2 cm. broad; flowers in compound, axillary racemes; pod coiled, 1-seeded, not winged.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1611; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2729.

Range: Brazil and the Guianas.

Drepanocarpus lunatus G. F. W. Meyer, the Bindoree or Bindoree Pimpler, is reported by Hitchcock (1921) as one of the species making up the mangrove formations along the coast and river shores. It has racemes of rather small blue flowers and flat curved or lunate pods. The short firm recurved stipular prickles make the plant a well-armed one.

8. DALBERGIA Linnæus filius

1. **Dalbergia monetaria** Linnæus filius, Supplementum Plantarum 317. 1781.

Ecastaphyllum Richardi var. *monetaria* Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 277. 1807.

A shrub or small tree; leaves alternate, simple or odd-pinnate; leaflets 1 or 3-5, ovate to ovate-elliptic, acuminate to mucronate at the apex, 6-15 cm. long, 3-8 cm. broad; flowers white or yellowish, in short, contracted, axillary, corymbose racemes; pod flat, suborbicular, 1-seeded, indehiscent.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2978.

Range: American tropics.

9. PTEROCARPUS Linnæus

Calyx velvet-hairy. 1. *P. Rohrii*

Calyx glabrous, or nearly so. 2. *P. officinalis*

1. **Pterocarpus Rohrii** Vahl, Symbolæ Botanicæ 2: 79. 1791.

Lingoum Rohrii O. Kuntze, Revisio Generum Plantarum 1: 193. 1891.

A tree; leaves alternate, odd-pinnate; leaflets 5-9, oblong to ovate, acuminate, 8-12 cm. long, 3-6 cm. broad; flowers yellow, in long, loose panicles; pod flat, indehiscent.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2009; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2416; Malali, Demerara River, Lat. 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2616.

Range: Brazil and the Guianas.

2. **Pterocarpus officinalis** Jacquin, Selectarium Stirpium Americanarum Historia 283. pl. 183, f. 92. 1763.

BLOODWOOD, CORKWOOD

Pterocarpus Draco Linnæus, Species Plantarum ed. 2. 1662. 1763.

Moutouchi suberosa Aublet, Histoire des Plantes de la Guiane Française 2: 748. pl. 299. 1775.

A glabrous tree 8-15 m. high; leaves alternate, odd-pinnate; leaflets 5-9, oblong-elliptic, short acuminate, 5-15 cm. long, 3-8 cm. broad; flowers yellow, in loose panicles; pod oblique, about 4 cm. in diameter.

This species occurs oftenest in depressions between sand hills. The wood is whitish, fine-grained, but not durable. The bark, when cut, exudes a blood-red sap which solidifies and forms a red resin which was formerly used in medicine under the name of Dragon's Blood, and was once exported to Spain from Colombia.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2724.

Range: South America.

10. MACHÆRIUM Persoon

Leaves densely tomentose beneath.....1. *M. quinatum*

Leaves not densely tomentose beneath:

Leaflets 7-15 cm. long.....2. *M. floribundum*

Leaflets 2-8 cm. long.....3. *M. leiophyllum*

1. *Machærium quinatum* (Aublet) Sandwith, Kew Bulletin 1931: 359. 1931.

Nissolia quinata Aublet, Histoire des Plantes de la Guiane Française 2: 743. pl. 297. 1775.

Machærium ferrugineum Persoon, Systema Plantarum seu Enchiridium Botanicum 2: 276. 1807.

A small tree; leaves alternate, odd-pinnate; leaflets 11-15, oblong to obovate, brown-tomentose beneath, bristle-tipped, emarginate or retuse at the apex, 5-10 cm. long, 2-5 cm. broad; flowers in great, compound panicles; pods about 8 cm. long, flat, curved, brown-tomentose.

Graham 171 was found growing in the water along the shore of the Cuyuni River.

Vicinity of Kartabo, July 5, 1924, *Graham 171*; vicinity of Wismar, on the Demerara River, Lat. $6^{\circ} N.$, October 12-16, 1922, *De La Cruz 2461*; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz 2640*.

Range: Northern South America.

2. *Machærium floribundum* Bentham, Journal of the Linnæan Society Suppl. 4: 68. 1860; in Martius, Flora Brasiliensis 15¹: 254. 1862.

A tree about 7 m. high; leaves alternate, leathery, odd-pinnate; leaflets 5-9, oblong to obovate, mucronate, up to 15 cm. long, 5 cm. broad; flowers brown or cream-colored, in lateral compound panicles.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3033.

Range: Brazil and the Guianas.

3. **Machærium leiophyllum** Benthām, *Annalen des Wiener Museums der Naturgeschichte* 2: 100. 1838.

A small tree; leaves alternate, odd-pinnate; leaflets 7-11, ovate to obovate, acuminate, 5-8 cm. long, 1.5-3 cm. broad; flowers purple, in compound terminal panicles.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3057.

Range: Guianas.

Machærium Schomburgkii Benthām, the Itiki-boura-balli or Tigerwood, is reported by Zon and Sparhawk (1923) as a timber tree of the colony. It has deep brown, almost black, close-grained wood resembling mahogany and is used for cabinet work, paneling and furniture.

II. CROTALARIA Linnæus

Stipules none or only slightly developed; leaves 3-foliolate.....1. *C. incana*

Stipules developed into flanges flanking the internodes, with incurved, pointed apices; leaves simple.....2. *C. stipularia*

1. **Crotalaria incana** Linnæus, *Species Plantarum* 716. 1753.

RATTLEBOX

An erect, branched annual, copiously pilose; leaves alternate, long-petioled, 3-foliolate; leaflets rounded or broadly obovate; flowers greenish-yellow, in long racemes; pods inflated, densely hairy.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2465.

Range: A common weed in the American tropics.

2. **Crotalaria stipularia** Desvaux, *Journal de Botanique* 3: 76. 1814.

An erect annual herb 1 m. high or less; leaves alternate, simple, ovate, the stipules conspicuous, broadly decurrent, with a semi-lunar, incurved apex; racemes lateral, few-flowered; pod oblong, glabrous or nearly so.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1959.

Range: West Indies and the Guianas.

12. CAJANUS DeCandolle

1. **Cajanus flavus** DeCandolle, Catalogus Plantarum Horti Mons-
peliensis 85. 1813. PIGEON PEA

Cytisus Cajan Linnæus, Species Plantarum 739. 1753.

Cajanus bicolor DeCandolle, Catalogus Plantarum Horti Monspeliensis 85.
1813.

Cajanus indicus Sprengel, Systema Vegetabilium 3: 248. 1826.

Cajan Cajan Huth, Helios, Abhandlungen und Mitteilungen 11: 133. 1893.

Cajan Cajan Millspaugh, Field Museum of Natural History, Botanical Series
2: 53. 1900.

A pubescent shrub 1-3 m. high; leaves alternate, 3-foliolate; leaflets elliptic, up to 10 cm. long; flowers large, yellow, frequently tinged with red; pod acute, long-tipped, flattened, the valves impressed between the seeds.

The plant is grown for its edible seeds which form one of the chief foods of the colony.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2907.

Range: Native to Asia and grown in Central and South America.

13. CLITORIA Linnæus

1. **Clitoria javitensis** (Humbolt, Bonpland, and Kunth) Bentham,
Journal of the Linnæan Society 2: 42. 1858.

Neurocarpum javitense Humbolt, Bonpland, and Kunth, Nova Genera et Species
Plantarum 6: 409. 1823.

A climbing, woody shrub; leaves alternate, 3-foliolate; leaflets ovate-lanceolate, acuminate, stipulate, 9-15 cm. long, 4-7 cm. broad; flowers large, pink or white, in terminal racemes; pod flattened, 2-valved.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N.,
July 15-19, 1922, *De La Cruz* 1610.

Range: Mexico and the Guianas.

14. CENTROSEMA Bentham

Leaflets small, 3-8 cm. long, lance-ovate. 1. *C. brasilianum*
Leaflets large, 8-20 cm. long, broadly triangular-ovate. 2. *C. Plumieri*

1. **Centrosema brasilianum** (Linnæus) Bentham, Annalen des Wiener
Museums der Naturgeschichte 2: 118. 1838.

Clitoria brasiliana Linnæus, Species Plantarum 753. 1753.

Bradburya brasiliana O. Kuntze, Revisio Generum Plantarum 1: 164. 1891.

A rather slender, climbing herb; leaves alternate, 3-foliolate; leaflets lance-ovate, 3-8 cm. long, 1-3 cm. broad; flowers large, showy, white, axillary; pod linear, with a long, slender tip.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1886.

Range: Brazil and the Guianas.

2. **Centrosema Plumieri** (Turpin) Benth, Annalen des Wiener Museums der Naturgeschichte 2: 118. 1838.

Clitoria Plumieri Turpin, in Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 303. 1807.

Bradburya Plumieri O. Kuntze, Revisio Generum Plantarum 1: 164. 1891.

A robust, suffrutescent, climbing herb; leaves alternate, rough, 3-foliolate; leaflets broadly triangular-ovate, acute at the apex, 8-20 cm. long, 4-12 cm. broad; flowers large, showy, white, axillary; pod linear, ridged, long-pointed at the tip.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz*, 1887; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2003.

Range: South America.

15. **DIOCLEA** Humbolt, Bonpland, and Kunth

1. **Dioclea glabra** Benth, Annalen des Wiener Museums der Naturgeschichte 2: 133. 1838.

A robust, woody vine; leaves alternate, large, 3-foliolate; flowers purple, showy, in long, stout racemes; pod more or less compressed, the upper margin thickened.

Hingston (1932) reports the flowers of this vine to be conspicuous on the forest roof. *Graham* 273 represents a shrubby plant found along the shore of the Cuyuni River, the raceme of flowers full of ants.

Vicinity of Kartabo, July 17, 1924, *Graham* 273.

Range: Brazil and the Guianas.

16. **CALOPOGONIUM** Desvaux

Pubescence tomentose, appressed; leaflets more than 10 cm. long; flower spike more than 20 cm. long.....1. *C. caeruleum*

Pubescence pilose, spreading; leaflets less than 10 cm. long; flower spike less than 20 cm. long.....2. *C. mucunoides*

1. **Calopogonium cæruleum** (Benth) Hemsley, *Biologia Centrali-Americana*, Botany 1: 301. 1880.

Stenolobium cæruleum Benth, *Annalen des Wiener Museums der Naturgeschichte* 2: 125. 1838.

A sturdy, woody, climbing, velvety tomentose herb; leaves alternate, 3-foliolate; leaflets ovate, the lateral ones oblique, 5-20 cm. long, 5-15 cm. broad; flowers dark blue, numerous, in axillary, spike-like racemes 25-50 cm. long, exceeding the leaves; pod 5-8 cm. long, finely velvety pubescent.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2937.

Range: Mexico, West Indies and eastern tropical South America to southern Brazil.

2. **Calopogonium mucunoides** Desvaux, *Annales des Sciences Naturelles* I. 9: 423. 1826.

A pilose climbing herb; leaves alternate, 3-foliolate; leaflets ovate, the lateral ones oblique, 8-10 cm. long, 2-5 cm. broad; flowers blue-purple, in axillary racemes; pod 3-5 cm. long, constricted, brown-hairy.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1875; Pomeroon District, Tabla, September 28, 1921, *De La Cruz* 1231; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2687.

Range: Guianas.

17. PHASEOLUS Linnæus

1. **Phaseolus lunatus** Linnæus, *Species Plantarum* 724. 1753.

LIMA BEAN, SIEVA or CIVET BEAN

A large, herbaceous vine; leaves alternate, 3-foliolate; leaves deltoid or rhombic, obtuse to acuminate, glabrate; flowers greenish-white to purplish, in long racemes; pod broad, the seeds compressed.

Matope, Cuyuni River, July 24, 1924, *Graham* 344; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2448.

Range: Tropical America, now widely cultivated.

Bowdichia sp., known as Tatabo or Sciopera, is listed by Zon and Sparhawk (1923) as a timber tree of the colony. It has very hard wood used for cogs, shafts, mill-beds and paving. The fruit is used in the manufacture of perfumery. The genus is characterized by odd-

pinnate leaves and blue or white flowers in loose terminal racemes, the pod oblong-linear, membranous, compressed.

Centrolobium paræense Tulasne, the Kartang, a native of Brazil, is reported by British Empire Exhibition (1924) as a timber tree in the Rupununi District in the savannah regions. It might possibly occur in the Kartabo region as well.

Dipteryx odorata Willdenow, the Tonka Bean or Kumara, is also listed by Zon and Sparhawk (1923) as a timber tree. It has very hard wood used for cogs, shafts, mill-beds and paving and the fruit is used in the manufacture of perfumery. The leaves are abruptly pinnate, the flowers in terminal panicles and the pod ovoid, fleshy, drupe-like.

Dolichos lablab Linnæus, the Hyacinth Bean, Bonavist, or Bonnyvis, is reported by Hitchcock (1921) along the coast. It is a large herb or vine with white or purple flowers in long-stalked racemes and flat pods 7.5 cm. long. It is probably native to tropical Africa and is now cultivated for its beans, which form one of the staple foods of British Guiana. It now occurs spontaneously throughout the tropics.

Tephrosia toxicaria Persoon, according to Howes (1930) is a fish poison plant of the colony. It is also used as an insecticide. It is a shrub, velvety pubescent, with odd-pinnate leaves having 10-20 pairs of leaflets, flowers in terminal and axillary racemes, the pod long and narrow, pubescent.

Lonchocarpus Nicou (Aublet) DeCandolle, the Nicou, Haiari, or Cube, according to Killip and Smith (1930) is one of the most used of South American fish poisons. Like some other widely used fish poisons of northern South America, this species, when found by Killip and Smith in their travels, was never in flower or fruit. The roots of the plant are the parts used, other species of the genus being similarly employed. *L. Nicou* is a shrub or small tree with alternate odd-pinnate leaves having 2-3 pairs of leaflets which are about 17 cm. long and 8 cm. broad.

Vatairea guianensis Aublet, the Arisauro or Arisouroo, is a timber tree of the region reported by Zon and Sparhawk (1923). It has alternate, odd-pinnate leaves and glabrous, ovate leaflets. The legume is sub-rotund, ferruginous, the wood open-grained, rather soft, and of moderate value.

59. HUMIRIACEÆ.

I. HUMIRIA Aublet

1. **Humiria guianensis** Benthām, London Journal of Botany 2: 374. 1843.

A tree; leaves alternate, leathery, ovate to spatulate, cuneate at the base, retuse to emarginate at the apex, petiole half as long as the blade, 5-10 cm. long, 2-5 cm. broad; flowers in axillary, cymose panicles; fruit a drupe.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2644.

Range: Guianas.

Humiria floribunda Martius, listed by Zon and Sparhawk (1923), is known in the colony as Umiri, Tawonero, and Tauroniro. It is a timber tree with hard, strong, fine-grained, dark reddish-brown wood which is used for house frames, furniture and spokes. Beebe (1925) lists it as an abundant tree at Kartabo with edible fruit.

60. ERYTHROXYLACEÆ. Coca Family

I. ERYTHROXYLON Linnæus

1. **Erythroxylon citrifolium** St. Hilaire, Floræ Brasiliæ Meridionalis 2: 67. 1829.

A tree; leaves alternate, ovate to elliptic, stipulate, 8-15 cm. long, 2-4 cm. broad, tapering at both ends; flowers in axillary clusters; fruit a red berry.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1643; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1919.

Range: Brazil and the Guianas.

61. RUTACEÆ. Rue Family

I. MONNIERIA Linnæus

1. **Monnieria trifolia** Linnæus, Systema Naturæ ed. 10. 1153. 1759.

A low shrub or woody herb; leaves opposite, thin, 3-foliate; leaflets sparsely hairy, ovate-elliptic, the central obovate, about 4 cm. long; flowers white, in axillary racemes, at length deflexed; seeds black, papillose.

Graham 281 was about 6 dm. high and found at the edge of a jungle trail.

Vicinity of Kartabo, July 18, 1924, *Graham 281*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1987*; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2475*.

Range: South America.

Citrus aurantifolia Christmann, the Lime, is reported by Beebe (1925) in the vicinity of Kartabo where a few trees, now smothered by low growth, are still bearing fruit.

62. SIMARUBACEÆ.

Simaruba amara Aublet, the Simarupa, is a large timber tree listed by Zon and Sparhawk (1923). It has very soft, coarse-grained, white wood which is resistant to termites and is used for partitions and interior work and in the manufacture of matches. Beebe (1925) reports this tree as one of those which is often seen towering above the surrounding jungle.

63. BURSERACEÆ. Torchwood Family

1. PROTIUM Burmann

Leaves pinnate with generally 5-7 leaflets; flowers in dense, axillary clusters.

1. *P. guianense*

Leaves not pinnate, simple or generally trifoliolate; flowers in axillary, compound panicles. 2. *P. Schomburgkianum*

1. **Protium guianense** Marchand, in Baillon, *Adansonia* 8: 52. 1867.

Icica guianensis Aublet, *Histoire des Plantes de la Guiane Française* 1: 340. 1775.

Tingulunga guianensis O. Kuntze, *Revisio Generum Plantarum* 1: 107. 1891.

A tree; leaves alternate, pinnate; leaflets 5-7, ovate-elliptic, about 7 cm. long, 3 cm. broad; flowers white, in axillary clusters; fruit a drupe about 1 cm. long.

Graham 244 represents a slender sapling about 4 m. high.

Vicinity of Kartabo, July 13, 1924, *Graham 244*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1950*.

Range: American tropics.

2. **Protium Schomburgkianum** Engler, in Martius, *Flora Brasiliensis* 12²: 276. 1874.

Protium decandrum Marchand, in Baillon, *Adansonia* 8: 51. 1867.

A shrub or tree; leaves alternate, simple or trifoliate; leaflets ovate to ovate-oblong, acuminate at the apex, leathery, about 10 cm. long, 5 cm. broad, long-petioled; flowers in axillary, compound panicles; fruit a drupe.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3032.

Range: Guianas.

Protium heptaphyllum (Aublet) Marchand, the Haiawa or Torchwood, is reported by Beebe (1925) as a small tree of the clearings' edges with dense foliage and wood which, when pounded and teased out, is used by the Indians for candles.

Trattinickia rhoifolia Willdenow, the Ulu, Olu, or Ooloo, is listed by Zon and Sparhawk (1923) as a timber tree of the colony and of Brazil which has a light brown wood that is soft with a satiny luster. It is used for inside boarding, shelves, furniture and the manufacture of cigar boxes.

64. MELIACEÆ. Mahogany Family

Carapa guianensis Aublet, the Crabwood or British Guiana Mahogany, is one of the very valuable native timber trees listed by Zon and Sparhawk (1923). It resembles mahogany in color and texture, with moderately soft wood. The supply is large and it is the most widely used native wood for furniture and construction. It is also used for ships and boat building. From the seeds there is obtained an oil which was recommended to us by the natives as an ointment against chiggers. It is a tree 20-30 m. high with leaves of 8-10 pairs of leaflets, lanceolate-elliptic, the fruit subspherical, about 10 cm. in diameter, containing numerous oily seeds, and finally rupturing into 5 divisions.

Cedrela odorata Linnaeus, the Cedar or Kurana, is listed by Zon and Sparhawk (1923). It is rather widely distributed in South America and has red-brown, fairly coarse-grained, soft, durable wood which is much used for furniture, coffins, cigar boxes, interior finishing and construction. It is a tall tree native to the West Indies, with compound leaves and a capsular fruit which bursts into 5 parts, liberating the seeds which are winged.

65. MALPIGHIACEÆ. Malpighia Family

- a. Erect shrubs or trees.....1. *BYRSONIMA*
- aa. Woody trailing climbers, growing over rocks and trees:
 - b. Carpels each with a dorsal wing or crest:
 - c. Carpels crested, not winged, or wings beak-like, flat.
 - 2. *BRACHYPTERYS*
 - cc. Carpels winged:
 - d. Wing thickened on the lower margin.....3. *HETEROPTERYS*
 - dd. Wing thickened on the upper margin:
 - e. Perfect stamens 4.....4. *STIGMAPHYLLON*
 - ee. Perfect stamens 10.....5. *BANISTERIA*
 - bb. Carpels laterally winged as well as dorsally winged or crested:
 - c. Sepals valvate in the bud, oblanceolate to spatulate. 6. *DIPLOPTERYS*
 - cc. Sepals imbricate in the bud, ovate to lanceolate:
 - d. Wings lobed:
 - e. Wings with 2 long narrow lobes, diverging, X-shaped.
 - 7. *TETRAPTERIS*
 - ee. Wings 2-4-parted or not lobed.....8. *HIRÆA*
 - dd. Wings not lobed.....9. *MASCAGNIA*

1. *BYRSONIMA* L. C. Richard

Leaves orbicular to ovate, heavily reticulated; plant densely rusty-tomentose.

1. *B. rugosa*

Leaves ovate-elliptic, not heavily reticulated; plant glabrous or nearly so.

2. *B. altissima*

1. *Byrsonima rugosa* Benthams, London Journal of Botany 7: 118. 1848.

A tomentose shrub or tree; leaves simple, opposite, long-petioled, ovate to orbicular, 15-20 cm. long, 4-8 cm. broad; flowers yellowish, in dense, terminal racemes; fruit a drupe.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 393; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1582; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2742.

Range: Guianas.

2. *Byrsonima altissima* (Aublet) Kunth, Nova Genera et Species Plantarum 5: 14. 1821.

Malpighia altissima Aublet, Histoire des Plantes de la Guiane Française 1: 455. pl. 181. 1775.

A glabrous shrub or tree; leaves opposite, simple, ovate-elliptic, 8-20 cm. long, 3-8 cm. broad; flowers yellowish, in dense, terminal racemes; fruit a drupe.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1885.

Range: Guianas.

2. BRACHYPTERYS Adr. Jussieu

1. *Brachypterys ovata* (Cavanilles) Small, in North American Flora 25²: 138. 1910.

Banisteria ovata Cavanilles, Monadelphiae Classis Dissertationes Decem 9: 429. pl. 257, f. 1. 1790.

Stigmatophyllon ovatum Niedenzu, De Genere Stigmatophyllo 2: 31. 1900; Das Pflanzenreich 91 (IV. 141.): 515. 1928.

A woody vine; leaves simple, opposite, ovate to lanceolate, obtuse or more or less acute at the apex and rounded at the base; flowers long-pedicelled, 3-4 in an umbel; fruit a samara, 2-3 together, the wings beak-like, flat.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3025.

Range: West Indies, Central and South America.

3. HETEROPTERYS Kunth

1. *Heteropterys platyptera* DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 1: 592. 1824.

Banisteria longifolia Swartz, Prodromus Descriptionum Vegetabilium Indiae Occidentalis 75. 1788.

Heteropterys longifolia Niedenzu, De Genere Heteropteryge, in Arbeiten Botanisches Institut k. Lyceum Hosianum, Braunsberg 2: 53. 1903.

A climbing, woody shrub; leaves simple, opposite, oblong to elliptic, 10-30 cm. long, 5-15 cm. broad; flowers yellow, in spreading, paniculate racemes; fruit a samara.

Vicinity of Kartabo, July 17, 1924, *Graham* 272; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2422.

Range: American tropics.

4. STIGMAPHYLLON Adr. Jussieu

Leaves glabrous beneath.....1. *S. convolvulifolium*

Leaves pubescent beneath:

Leaves sagittate-reniform.....2. *S. fulgens*

Leaves ovate-elliptic, acuminate at the apex.....3. *S. puberum*

1. **Stigmaphyllon convolvulifolium** (Cavanilles) A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 372. 1843; Annales des Sciences Naturelles II. **13**: 289. 1840.

Banisteria convolvulifolium Cavanilles, Monadelphiae Classis Dissertationes Decem **9**: 428. 1790.

Banisteria dichotoma DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis **1**: 588. 1824; not *B. dichotoma* Linnæus 1753.

A more or less glabrous climbing shrub; leaves opposite, simple, orbicular, cordate, acuminate at the apex, about 10 cm. broad; flowers yellow, in long-peduncled, umbel-like corymbs; fruit a samara, wing of the seed with an obtuse appendage at the back.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3044.

Range: West Indies and northern South America.

2. **Stigmaphyllon fulgens** (Lamarck) A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 373. 1843; Annales des Sciences Naturelles II. **13**: 289. 1840.

Banisteria fulgens Lamarck, Encyclopédie Méthodique, Botanique **1**: 368. 1783.

A nearly glabrous, climbing shrub; leaves opposite, simple, sagittate reniform, cordate at the base, 10-12 cm. long, nearly as broad, acuminate at the apex; flowers yellow, in loose umbel-like corymbs; fruit a samara, with a deltoid appendage at the base of the wing.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2446.

Range: Guianas.

3. **Stigmaphyllon puberum** A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 376. 1843; Annales des Sciences Naturelles II. **13**: 289. 1840.

Banisteria pubera L. Richard, Actes de la Société d'Histoire Naturelle de Paris **1**: 109. 1792.

A sparingly pubescent climbing shrub; leaves opposite, simple, ovate-elliptic, 10-15 cm. long, 3-8 cm. broad; flowers yellow to red, in loose, umbel-like corymbs; fruit a samara, the wing obtuse-angled at the base.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2975.

Range: West Indies and the Guianas.

5. *BANISTERIA* Linnæus

- Leaves less than 15 cm. long.....1. *B. Martiniana*
 Leaves more than 15 cm. long:
 Flowers more than 2 cm. in diameter.....2. *B. platyptera*
 Flowers less than 2 cm. in diameter.....3. *B. reticulata*

1. ***Banisteria Martiniana*** A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 413. 1843; Annales des Sciences Naturelles II. **13**: 284. 1840.

A large, woody vine; leaves simple, opposite, ovate, acuminate, about 10 cm. long, 5 cm. broad; flowers yellow, in large, paniced cymes; fruit a samara, the wing 2.5 cm. long.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2684.

Range: Guianas.

2. ***Banisteria platyptera*** (DeCandolle) Grisebach, Linnæa **22**: 17. 1849.

A large, woody vine; leaves simple, opposite, oblong-elliptic, acuminate, up to 25 cm. long, 10 cm. broad; flowers yellow, in large paniced cymes; fruit a samara.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3001.

Range: Northern South America.

3. ***Banisteria reticulata*** (Poiret) C. B. Robinson, North American Flora **25**: 138. 1910.

Malpighia reticulata Poiret, in Lamarck, Encyclopédie Méthodique, Botanique Suppl. **4**: 8. 1816.

Heteropterys reticulata Niedenzu, De Genere Heteropteryge, in Arbeiten Botanisches Institut k. Lyceum Hosianum, Braunsberg **2**: 54. 1903; Das Pflanzenreich **91** (IV. 141.): 374. 1928.

A climbing, woody shrub; leaves simple, opposite, leathery, oblong-elliptic; flowers yellow, in terminal and axillary paniced cymes up to 3 dm. long; fruit a samara with a wing 3.5 cm. long, 2 cm. broad.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2973.

Range: Jamaica to the Guianas and Brazil.

6. DIPLOPTERYS Adr. Jussieu

1. **Diplopterys pauciflora** (G. F. W. Meyer) Niedenzu, Das Pflanzenreich **91** (IV. 141.): 230. 1928.

Triopteris pauciflora G. F. W. Meyer, Primitiæ Floræ Essequiboensis 183. 1818.

A low shrub or woody vine; leaves simple, opposite, ovate, tapering at the apex, 10-15 cm. long, 5-8 cm. broad, smooth and leathery; flowers small, in cymose panicles in the axils of the leaves; fruit a samara.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2709.

Range: Para and the Guianas.

7. TETRAPTERIS Cavanilles

1. **Tetrapteris fimbripetala** A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 544. 1843; Annales des Sciences Naturelles II. **13**: 263. 1840.

A climbing shrub; leaves opposite, entire, ovate-elliptic, mucronate, 10-15 cm. long, 3-6 cm. broad; flowers white to red or yellow, in loose, axillary panicles; fruit a samara, the wings X-shaped, the two upper divisions generally larger than the two lower ones.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1571; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2671.

Range: Guianas.

8. HIRÆA Jacquin

1. **Hiræa chrysophylla** A. Jussieu, Archives de la Muséum d'Histoire Naturelle **3**: 572. 1843; Annales des Sciences Naturelles II. **13**: 258. 1840.

A climbing shrub; leaves simple, opposite, elliptic-oblong, 8-15 cm. long, 3-7 cm. broad, silky beneath; flowers yellow-brown, in lateral umbels in the axils of the leaves; fruit a samara.

Vicinity of Kartabo, July 1924, *Graham* 97; Pomeroron River, Pomeroron District, January 14-20, 1923, *De La Cruz* 2977.

Range: Guianas and northern Brazil.

9. MASCAGNIA Bertero

- Leaves ovate-elliptic, tomentose beneath.....1. *M. leucanthele*
Leaves ovate-spherical, glabrous beneath when mature.....2. *M. sepium*

1. **Mascagnia leucanthele** Grisebach, in Martius, Flora Brasiliensis 12¹: 96. 1858.

A pubescent, climbing shrub; leaves simple, opposite, elliptic, tapering at both ends, densely green-tomentose beneath; flowers white, in loose, spreading, paniculate cymes; fruit a samara, the wing of the seed membranous, semi-circular to circular.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2653.

Range: Brazil and the Guianas.

2. **Mascagnia sepium** (A. Jussieu) Grisebach, in Martius, Flora Brasiliensis 12¹: 96. 1858.

Hiræa sepium A. Jussieu, in St. Hilaire, Floræ Brasiliæ Meridionalis 3: 19. 1832.

A climbing woody shrub; leaves simple, opposite, ovate to orbicular, pubescent below when young, about 10 cm. long, 6 cm. broad; flowers in paniculate cymes; fruit a samara, the wing of the seed semi-circular to circular.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1878.

Range: Brazil and the Guianas.

Spachea elegans A. Jussieu, the Pigeon Berry, is reported from Kartabo by Beebe (1925). It is a medium-height tree which flowers in April with paniced blossoms which are visited by hosts of birds and insects. Beebe states that a decoction of the bark is used as an astringent, and by the natives for dressing cuts.

66. VOCHYSIACEÆ. Vochysia Family

1. VOCHYSIA A. L. Jussieu

1. **Vochysia tetraphylla** (G. F. W. Meyer) DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 3: 27. 1828.

ITE-BALLI, ETA-BALLI, ÆTA-BALLI

Cucullaria tetraphylla G. F. W. Meyer, Primitiæ Floræ Essequibænsis 12. 1818.

A tree; leaves opposite or verticillate, glossy, leathery, ovate to elliptic, short-petioled, 10-20 cm. long, 5-10 cm. broad, abruptly acuminate at the apex; flowers in rather dense, axillary or terminal cymose clusters; fruit a 3-angled capsule.

The Ite-balli is reported by Zon and Sparhawk (1923) as a timber tree with orange flowers and pinkish, fairly soft wood which is durable in salt water and useful in the making of furniture.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2714.

Range: Guianas.

67. POLYGALACEÆ. Milkwort Family

Climbing; leaves abrupt to cordate at the base, oblong, acuminate to mucronate at the apex; petals not linear, broad.....1. *SECURIDACA*

Shrub or tree; leaves cuneate at the base, ovate-lanceolate, acute at the apex; petals linear.....2. *BARNHARTIA*

1. *SECURIDACA* Linnæus

1. *Securidaca Hostmanni* Miquel, Tidschrift voor de Wisen Natuurkundige Wetenschappen 1: 153. 1848; Stirpes Surinamenses Selectæ 30. 1850.

Elsota Hostmanni O. Kuntze, Revisio Generum Plantarum 1: 46. 1891.

A climbing vine or shrub; leaves alternate, oblong-ovate, 8-10 cm. long, 4-7 cm. broad, mucronate at the tip; flowers pink, in terminal and axillary racemes; fruit a samara with a curved wing about 4 cm. long.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1572; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2903.

Range: Guianas.

2. *BARNHARTIA* Gleason

1. *Barnhartia floribunda* Gleason, Bulletin of the Torrey Botanical Club 53: 297. 1926.

A shrub or small tree; leaves alternate, firm, elliptic-oblong, 10-15 cm. long, 3-5 cm. broad, entire, with reticulate venation, acute at the apex, tapering at the base; flowers white to orange, in 1-3 simple or paniced raceme-like spikes borne in the upper axils of the leaves; fruit unknown.

The short history of this genus has been an interesting one. Placed originally by Gleason in the Styracaceæ, Sandwith later placed it in the Diclidantheraceæ (see Kew Bulletin 1931: 485. 1931) and still later, Sprague and Sandwith (see Hooker's Icones Plantarum pl. 3172, 1932) put it in the Polygalaceæ, where it now rests.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2727.

Range: British Guiana.

68. DICHAPETALACEÆ.

Petals free or united only with one another and with the stamens at the base.

1. DICHAPETALUM

Petals united into a corolla with a long tube.....2. TAPURA

1. DICHAPETALUM Thouars

1. **Dichapetalum pedunculatum** (DeCandolle) Baillon, Histoire des Plantes 5: 140. 1874.

Chailletia pedunculata DeCandolle, Annales du Muséum d'Histoire Naturelle 17: 154. 1811.

A climbing shrub; leaves alternate, entire, stipulate, ovate-oblong to elliptic, 10-15 cm. long, 5-8 cm. broad; flowers white, in axillary corymbiform cymes, the peduncles often adhering to the base of the petiole; fruit a drupe.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1596; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1895; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2625.

Range: Guianas.

2. TAPURA Aublet

1. **Tapura guianensis** Aublet, Histoire des Plantes de la Guiane Française 1: 126. 1775.

A woody shrub; leaves leathery, alternate, entire, ovate-lanceolate, bluntly acuminate; flowers yellow, axillary; fruit a drupe about 2 cm. long with a thick rind.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1917.

Range: Guianas.

69. EUPHORBIACEÆ. Spurge Family

- a. Flowers in involucre; calyx represented by a minute scale at the base of the filament-like pedicel; glands of the involucre with petal-like appendages, these sometimes much reduced.....1. EUPHORBIA

- aa. Flowers not in involucre; calyx of several sepals:
 - b. Ovules and seeds 2 in each cavity:
 - c. Petals present; trees or shrubs.....2. *AMANOA*
 - cc. Petals absent; herbs.....3. *PHYLLANTHUS*
 - bb. Ovules and seeds 1 in each cavity:
 - c. Lobes of the staminate calyx valvate in the bud:
 - d. Stamens numerous.....4. *CONCEVEIBA*
 - dd. Stamens 2-8.....5. *ALCHORNEA*
 - cc. Lobes of the staminate calyx imbricate or separated in the bud:
 - d. Leaves palmately compound, divisions 5-7.....6. *MANIHOT*
 - dd. Leaves simple:
 - e. Stamens many, 6-50, rarely fewer; trees.....7. *MABEA*
 - ee. Stamens 1-2, rarely 3; herbs.....8. *SEBASTIANA*

I. EUPHORBIA Linnæus

1. **Euphorbia hyssopifolia** Linnæus, *Systema Naturæ*, ed. 10. 1048. 1759.

Chamæsyce hyssopifolia Small, *Bulletin of the New York Botanical Garden* 3: 429. 1905; *Flora of the Southeastern United States* ed. 2. 1349. 1913.

A woody, annual or perennial herb 3.5 m. high or more; leaves opposite, narrowly oblong, obtuse at the apex, 1-3 cm. long; flowers in loose, terminal cymes borne on very slender branches; capsules about 1 mm. long, 2 mm. broad, glabrous; seeds red or brown.

Matope, Cuyuni River, July 23, 1924, *Graham* 332.

Range: American tropics.

Euphorbia pulcherrima Willdenow, the Poinsettia of our Christmas displays, may be observed in gardens growing as a shrub 2-3 m. high, its showy scarlet bracts quite conspicuous against the pale green, irregularly lobed leaves. A native of Central America and Mexico, it is grown as an ornamental in many tropical American countries. The latex of the roots of **Euphorbia cotinoides** Miquel is used as an arrow poison according to Cheney (1931).

2. AMANO Aublet

1. **Amanoa guianensis** Aublet, *Histoire des Plantes de la Guiane Française* 1: 256. 1775.

A shrub; leaves alternate, entire, leathery, ovate, about 10 cm. long, 6 cm. broad, abruptly acuminate; flowers white or yellow, sessile, in terminal or lateral zigzag, spike-like racemes.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2415.

Range: Guianas.

3. PHYLLANTHUS Linnaeus

1. *Phyllanthus urinaria* Linnaeus, Species Plantarum 982. 1753.

An erect or procumbent annual herb 1 m. high or less; leaves alternate, oblong, sensitive, apex rounded or apiculate, .5-2 cm. long, so arranged as to appear like the leaflets of a compound leaf; flowers minute, solitary in the axils of the leaves, the male on the uppermost parts of the branches; fruit a small, flattened, spherical capsule.

Certain other species of this genus are cultivated by the natives as fish poison plants, according to Howes (1930).

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 222; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1971.

Range: Native to the old world tropics; now throughout the tropics although rare in Africa.

4. CONCEVEIBA Aublet

1. *Conceveiba guyanensis* Aublet, Histoire des Plantes de la Guiane Françoise 2: 924. pl. 353. 1775.

A somewhat woody, pubescent shrub; leaves alternate, long-petioled, lanceolate-elliptic, long-acuminate at the apex; flowers in terminal panicles; fruit hard, large, ovoid-globose, 20 mm. long, definitely 3-angled.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1650.

Range: Guianas.

5. ALCHORNEA Swartz

1. *Alchornea triplinervia* (Sprengel) Mueller-Argoviensis, in DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 15²: 909. 1866.

Antidesma triplinervium Sprengel, Neue Entdeckungen im ganzen Umfang der Pflanzenkunde 2: 116. 1821.

A shrub or small tree; leaves alternate, three-nerved, ovate, somewhat puberulent beneath, 6-12 cm. long, 4-6 cm. broad, petioles 2-4 cm. long; flowers white, in short, axillary clusters of spikes which are shorter than the leaves; fruit a small, globular, splitting capsule with the two styles conspicuously persistent at the tip.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2010.

Range: Brazil and the Guianas.

6. MANIHOT Adanson

1. **Manihot utilisima** Pohl, *Plantarum Brasiliæ Icones et Descriptiones Hactenus Ineditæ* 1: 32. pl. 24. 1827. CASSAVA, YUCA

Jatropha Manihot Linnæus, *Species Plantarum* 1007. 1753.

Janipha Manihot Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 2: 108. 1817.

Manihot Manihot Karsten, *Deutsche Flora* 588. 1882.

Manihot Manihot Cockerell, *Bulletin of the Torrey Botanical Club* 19: 95. 1892.

A glabrous herb 3 m. high or less, sometimes shrub-like; leaves palmately 3-7 parted, the divisions narrow, entire, glaucous beneath; inflorescence, which branches from the base, is in the form of racemes either terminal or in the upper axils, the upper ones male, the lower female; capsule winged.

The many cultivated varieties of Cassava seem to segregate themselves into two groups, one in which the roots are harmless, known as Sweet Cassava, the other with very poisonous hydrocyanic acid in the roots, known as Bitter Cassava. The poisonous elements can be destroyed by heating or by pressing out the juice, for which the natives have developed an efficient method. A flour is then prepared from the abundant starch contained in the roots which furnishes one of the most important foods of the natives, and tapioca is made from this starch as well. Some species of the genus are cultivated for rubber in northern South America.

Vicinity of Kartabo, August 3, 1924, *Graham* 412.

Range: Native of Brazil, now cultivated throughout the American tropics.

7. MABEA Aublet

1. **Mabea Piriri** Aublet, *Histoire des Plantes de la Guiane Française* 2: 867. 1775.

A shrub; leaves alternate, oblong-elliptic, serrulate, abruptly long-acuminate to mucronate, 6-12 cm. long, 2-4 cm. broad; flowers monœcious, in terminal, spike-like racemes; fruit a capsule 1-2 cm. long.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1651.

Range: Guianas.

8. SEBASTIANA Sprengel

1. **Sebastiania corniculata** (Vahl) Mueller-Argoviensis, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 15²: 1168. 1866.

Tragia corniculata Vahl, *Eclogæ Americana* 2: 55. pl. 19. 1798.

A much-branched woody annual 1 m. high or less; leaves alternate, ovate-lanceolate, appressed-serrulate, 3-5 cm. long, tapering from a rounded base to an attenuate apex; flowers solitary in the axils of the leaves; fruit a capsule 3 mm. long, tipped with spines.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2920.

Range: Widespread in the American tropics.

Acalypha Wilkesiana Mueller, the Copper Leaf, native of the Pacific Islands, is reported by Hitchcock (1921) as a cultivated plant along the coast, and it may occur in some of the river villages. It is a shrub 3 m. high or less, with ovate, nearly glabrous, vari-colored leaves 1-2 dm. long, the staminate spikes nearly as long as the leaves, the pistillate shorter.

Codiaeum variegatum Blume and its varieties, the Crotons or Variegated Laurels, native to Malay, are cultivated in Georgetown and the villages. They are shrubs with alternate, variegated, leathery leaves which are generally ovate to linear and may be somewhat lobed; the flowers are monœcious, in slender axillary racemes, the staminate with petals, the pistillate apetalous.

Hevea sp., known as Hatteeballi, is a tall jungle tree reported by Beebe (1925).

Hura crepitans Linnæus, the Sand-Box Tree, is a large tree with spreading crown widely distributed in tropical America. The leaves are somewhat cordate, sometimes shorter than the petiole, biglandular above at the base, the flowers monœcious in long-peduncled terminal spikes. The fruit is a capsule about the size of a small orange, becoming dry and bursting eventually with much force. The seeds rattle in the dry fruit, hence the name Sand-Box Tree. Cheney (1931) reports the milky latex of this tree to be very toxic and used in northern South America as an arrow poison.

Hyeronima laxiflora Mueller-Argoviensis, the Suradanni or Seridani, is a large tree listed by Zon and Sparhawk (1923). It has coarse-grained wood resembling mahogany which is used for making furniture, boats, canoes and ties. It is a native tree with entire leaves and flowers in compound spikes.

Ricinus communis Linnæus, the Castor Oil Plant, is commonly cultivated. A native of the old world, it is cultivated for its seeds, the source of castor-oil. The plant is 1-5 m. high, with 6-11 palmately-lobed leaves 1-6 dm. broad and small apetalous greenish flowers in terminal racemes, the pistillate above the staminate. The capsules are 10-12 mm. in diameter, usually spiny, the seeds smooth, black, variegated with white or mottled.

Sapium Jenmani Hemsley, the Wild Rubber, is a large native tree reported by Beebe (1925). It has smooth bark and buttressed roots.

70. ANACARDIACEÆ. Sumac Family

Ovary 2-5-celled; leaves pinnate:

Petals valvate in the bud; leaves acute to truncate at the base...1. *SPONDIAS*

Petals imbricate in the bud; leaves cuneate at the base.....2. *TAPIRIRA*

Ovary 1-celled; leaves simple.....3. *ANACARDIUM*

1. *SPONDIAS* Linnæus

1. ***Spondias lutea*** Linnæus, Species Plantarum, ed. 2. 613. 1762.

WILD OR HOG PLUM, JOBO

Spondias Mombin Linnæus, Species Plantarum 371. 1753.

A tree, often 10-15 m. high or higher; leaves alternate, odd-pinnate, deciduous; leaflets 9-19, abruptly acuminate at the apex, glabrous or nearly so, 5-10 cm. long, 3-5 cm. broad; flowers white, fragrant, in large, terminal panicles; fruit ovoid, yellow, 3-4 cm. long.

The fruit is eaten by birds and mammals and is often planted by man for shade and for the fruit, the thin pulp of which is pleasantly acid.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1951.

Range: Cosmopolitan in the tropics.

2. *TAPIRIRA* Aublet

1. ***Tapirira guianensis*** Aublet, *Histoire des Plantes de la Guiane Françoise* 1: 470. 1775. DUKA

A fairly large tree; leaves alternate, odd-pinnate; leaflets 3-7, oblong-elliptic, acuminate, 6-15 cm. long, 2-6 cm. broad; flowers white to yellowish, in axillary and terminal, loosely spreading panicles; fruit a drupe.

The wood of the Duka resembles inferior mahogany and is used for interior work.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1997; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2438; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2728.

Range: Guianas.

3. *ANACARDIUM* Linnæus

1. ***Anacardium occidentale*** Linnæus, *Species Plantarum* 383. 1753. CASHEW

A small tree; leaves alternate, simple, obovate, tapering at the base, rounded to emarginate at the apex, glabrous, 10-15 cm. long, 3-8 cm. broad; flowers small, in terminal, wide-spreading panicles; fruit a kidney-shaped drupe with 1 large seed, borne on the apex of the fleshy peduncle, which itself appears to be a fleshy fruit, red or yellow.

The drupe provides the Cashew nut of commerce, while the fleshy peduncle is itself sweet, juicy, spongy, and agreeable to the taste. The oil is driven from the nut by roasting when it becomes edible and similar to the almond in qualities. The oil is used to protect wood and bookbindings from termites and other insects.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2708.

Range: West Indies and continental tropical America, now naturalized throughout the tropics.

Anacardium rhinocarpus DeCandolle, the Wild Cashew, Hoomalgee, or Hubudi, is reported by Beebe (1925) as a frequent tall tree of the deep jungle.

Mangifera indica Linnæus, the Mango, a large tree with long, lanceolate-elliptic leaves, is much cultivated for its edible fruit.

71. AQUIFOLIACEÆ. Holly Family

1. ILEX Linnæus

Leaves entire, ovate to spatulate-ovate, acute or acuminate at the apex.

1. *I. guianensis*

Leaves slightly serrate, ovate to elliptic, acuminate to long-attenuate at the apex.

2. *I. Martiniana*

1. **Ilex guianensis** (Aublet) O. Kuntze, *Revisio Generum Plantarum* 1: 113. 1891.

Macoucoua guianensis Aublet, *Histoire des Plantes de la Guiane Française* 1: 88. pl. 34. 1775.

A tree; leaves alternate, simple, ovate to spatulate-ovate, 6-12 cm. long, 3-6 cm. broad, acute or acuminate at the apex; flowers in short, cymose, axillary clusters; fruit a small, berry-like drupe.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3019.

Range: Guianas.

2. **Ilex Martiniana** D. Don, in Lambert, *A Description of the Genus Pinus* ed. 2. 2: 8. pl. 5. 1828.

A tree; leaves alternate, leathery, ovate or elliptic, acuminate-attenuate, up to 15 cm. long; flowers white or yellow, in dense, compound, axillary racemes; fruit a berry-like drupe, red, of 4 nuts.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1616; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2017; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2439; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2626.

Range: Guianas.

72. CELASTRACEÆ. Bittersweet Family

1. GOUPIA Aublet

1. **Goupia glabra** Aublet, *Histoire des Plantes de la Guiane Française* 1: 296. 1775.

KABUKALLI

A tree; leaves alternate, leathery, elliptic, tapering at both ends; flowers yellow, in lateral umbels from a stout peduncle; fruit a black berry.

The tree attains a large size, with reddish-brown, close-grained wood which is used for furniture, building, ties and paving. The natives make canoes of the trunk.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2716.

Range: Guianas.

73. HIPPOCRATEACEÆ. Hippocratea Family

Fruit dry, 3-seeded, these connate at the base, compressed vertically and wing-like, mature seeds broadly winged. 1. *HIPPOCRATEA*

Fruit berry-like, 1-many-seeded, terete, mature seeds not winged. . . . 2. *SALACIA*

1. HIPPOCRATEA Linnæus

1. *Hippocratea volubilis* Linnæus, Species Plantarum 1191. 1753.

Hippocratea ovata Lamarck, Illustrationes des Genres 1: 100. pl. 28, f. 2. 1791.

A climbing shrub; leaves opposite, ovate-elliptic, crenate-serrate, acute at the apex, 10-15 cm. long, 4-6 cm. broad; flowers in loose, axillary cymes; carpels flat, wing-like, spreading, oblong, enclosing several winged seeds.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2688; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3003.

Range: South America.

2. SALACIA Linnæus

1. *Salacia attenuata* (Miers) Peyritsch, in Martius, Flora Brasiliensis 11¹: 149. 1878.

Tontelea attenuata Miers, Transactions of the Linnæan Society 28: 384. pl. 23. 1872.

A climbing shrub; leaves opposite, ovate-acuminate, 8-15 cm. long, 3-6 cm. broad; flowers white, in spreading, axillary cymes; fruit berry-like, round, many-seeded.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1629; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1640.

Range: Brazil and the Guianas.

74. SAPINDACEÆ. Soapberry Family

Plants scandent; inflorescence usually bearing tendrils:

Fruit of 3 samaras, the seed borne at the apex of the samara...1. *SERJANIA*

Fruit a terete or 3-winged capsule.....2. *PAULLINIA*

Plants erect; inflorescence without tendrils:

Sepals distinct.....3. *CUPANIA*

Sepals united.....4. *MATAYBA*

1. *SERJANIA* Plumier

1. *Serjania paucidentata* DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis 1: 603. 1824.

A climbing shrub; leaves alternate, mostly biternately compound; leaflets leathery, ovate to elliptic, abruptly acuminate, 3-8 cm. long, 1.5-4 cm. broad; flowers white, in axillary racemes; fruit of 3 samaras attached by their backs.

Species of *Serjania*, as well as of *Paullinia* and *Sapindus*, due to their high saponin content, are used as fish poison plants of South America, according to Howes (1930).

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2711.

Range: Brazil and the Guianas.

2. *PAULLINIA* Linnæus

1. *Paullinia Hitchcockii* Gleason, Bulletin of the Torrey Botanical Club 54: 614. 1927.

A climbing shrub; leaves alternate, pinnate or decompose; leaflets 3-7, ovate to obovate, dentate-crenate, 8-12 cm. long, 3-6 cm. broad; flowers in axillary, spike-like racemes; fruits red, 3-winged above the middle, surface of the wings conspicuously veined.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1617.

Range: British Guiana.

3. *CUPANIA* Linnæus

Fruit, branches and leaves glabrous or nearly so.....1. *C. scrobiculata*

Fruit, branches and leaves hirsute.....2. *C. hirsuta*

1. **Cupania scrobiculata** Humbolt, Bonpland and Kunth, Nova Genera et Species Plantarum 5: 127. 1821.

A glabrous tree; leaves alternate, pinnate; leaflets ovate to obovate, slightly dentate near the apex, 6-12 cm. long, 3-6 cm. broad; flowers white, in axillary panicles; fruit a 3-parted capsule, glabrous or slightly pubescent.

Pomeroon District, Tabla, September 28, 1921, *De La Cruz* 1237.

Range: Northern South America.

2. **Cupania hirsuta** Radlkofer, Königlich-Bayerische Academie der Wissenschaften Sitzungsberichte Mathamatisch-physikalische Classe, Muenchen 9: 565. 1879.

A small, very brown-tomentose tree; leaves alternate, pinnate; leaflets dentate, oblong-elliptic to ovate, acuminate, smooth above, rusty-tomentose below, 5-20 cm. long, 3-8 cm. broad; flowers small, white, in axillary panicles; fruit a 3-parted capsule, rusty-tomentose; seeds brownish-black.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1922.

Range: Guianas.

4. MATAYBA Aublet

1. **Matayba guianensis** Aublet, Histoire des Plantes de la Guiane Françoise 1: 331. 1775.

A small tree; leaves alternate, pinnate; leaflets oblong-elliptic, tapering at both ends, 8-12 cm. long, 2-4 cm. broad; flowers in paniced racemes; fruit a small, 3-lobed capsule.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1898.

Range: Guianas.

75. VITACEÆ. Grape Family

1. CISSUS Linnæus

1. **Cissus erosa** L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 106. 1792.

Vitis erosa Baker, in Martius, Flora Brasiliensis 14²: 210. 1871.

A climbing shrub; leaves alternate, 3-foliolate; leaflets elliptic, irregularly dentate, 5-8 cm. long, 2-4 cm. broad; flowers red, in compound cymes; fruit a small berry.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 2030.

Range: American tropics.

76. TILIACEÆ. Linden Family

1. TRIUMFETTA Linnæus

1. **Triumfetta semitriloba** Jacquin, Enumeratio Plantarum quas in Insulis Caribæis 22. 1760.

Triumfetta althæoides Lamarck, Encyclopédie Méthodique, Botanique 3: 420. 1791.

A somewhat rough, tomentose annual, 1-1.5 m. high; leaves alternate, ovate, rhombic or suborbicular, sometimes 3-lobed, 3-10 cm. long, nearly as broad, crenate; flowers yellow, clustered in the axils of the leaves; fruit a capsule 3-5 mm. in diameter, densely echinate.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1913; vicinity of Wismar, Demerara River, Lat. $6^{\circ} N.$, October 12-16, 1922, *De La Cruz* 2456.

Range: Continental tropical America.

77. MALVACEÆ. Mallow Family

Fruit a capsule, the cells dehiscent on the outer side, not separating from each other at maturity; involucre subtended by bractlets:

Bractlets of the involucre 3, cordate. 1. *GOSSYPIMUM*

Bractlets of the involucre 5 or more. 2. *HIBISCUS*

Fruit not capsular, composed of few or numerous carpels, these separating from each other at maturity; involucre not subtended by bractlets. 3. *SIDA*

1. GOSSYPIMUM Linnæus

1. **Gossypium barbadense** Linnæus, Species Plantarum 693. 1753.
SEA ISLAND COTTON

Hibiscus barbadensis var. *latifolius* O. Kuntze, Revisio Generum Plantarum 1: 68. 1891.

A tall, stout herb; leaves alternate, large, 3-lobed; flowers white to greenish inclosed by several large, deeply toothed bracts; fruit a large capsule.

The seeds are covered with a short fuzz and with a layer of longer, whitish hairs known as lint, from which the cotton of commerce is obtained.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2410.

Range: From the Carolinas to Florida, the Bahamas, West Indies; now cultivated and spontaneous throughout the tropics generally.

2. HIBISCUS Linnæus

Involucral bractlets distinctly bifurcate at the apex:

Leaves and stem wooly-pubescent.....1. *H. furcellatus*

Leaves and stem spinulose hairy.....2. *H. bifurcatus*

Involucral bractlets not bifurcate:

Petals laciniate, much divided.....3. *H. schizopetalus*

Petals not laciniate, more or less entire.....4. *H. rosa-sinensis*

1. **Hibiscus furcellatus** Lamarck, Encyclopédie Méthodique, Botanique, 3: 358. 1789.

Hibiscus tomentosus Stahl, Estudios Sobre la Flora de Puerto Rico 2: 92. 1884; not *H. tomentosus* Miller 1768.

Hibiscus fraternus Sessé and Mocino, Flora Mexicana ed. 2. 161. 1894; not *H. fraternus* Linnæus 1775.

A roughly pubescent shrub about 1 m. high; leaves alternate, cordate, sometimes 3-lobed, irregularly dentate; flowers pink, 5-10 cm. long; fruit a capsule a little shorter than the calyx.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2025.

Range: American tropics.

2. **Hibiscus bifurcatus** Cavanilles, Monadelphæ Classis Dissertationes Decem 3: 146. pl. 51, f. 1. 1787.

A prickly undershrub 1-2 m. high; leaves alternate, 3-lobed to about half-way, the lower cordate; peduncles solitary in the axils of the upper leaves; flowers purple, 7-9 cm. long; fruit a capsule provided with long, silky hairs.

Graham 127 was over 2 m. tall found growing in a swamp along a clearing trail. The leaves were much eaten, apparently by insects.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 127.

Range: American tropics.

3. **Hibiscus schizopetalus** (Masters) Hooker filius, in Curtis, Botanical Magazine III. 36: pl. 6524. 1880. CORAL HIBISCUS

Hibiscus rosa-sinensis var. *schizopetalus* Masters, in The Gardeners' Chronicle New Series 12: 272. 1879; Boulger, l.c. 372.

A tall, glabrous shrub with slender, drooping branches; leaves alternate, ovate-elliptic, dentate, long-petioled; flowers pendulous, red or orange, the recurved petals deeply and handsomely cut; fruit a capsule.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1988.

Range: Native to the African tropics, now also throughout the American tropics.

4. **Hibiscus rosa-sinensis** Linnæus, Species Plantarum 694. 1753.

CHINESE HIBISCUS, SHOE-BLACK

A shrub 1-3 m. high; leaves alternate, ovate, irregularly crenate, acuminate; flowers red, handsome, the staminal tube much longer than the corolla; fruit a capsule 2.5 cm. long.

The plant is frequently grown as a hedge. The petals turn black when crushed and are used in blackening shoes, and in China the women use the flower to dye the hair and eyebrows. There, also, the flowers are pickled and eaten and used to color spiritous liquors. The petals give paper a blue tint which reacts like litmus.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1673; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1976.

Range: Probably native to tropical Asia, now found throughout the tropics.

Hibiscus syriacus Linnæus, the Rose of Sharon, is conspicuous in Georgetown and the villages as a cultivated plant, according to Hitchcock (1921) who also reports that the juicy calyces of **H. sabdariffa** Linnæus, the Sorrel or Roselle, native to the East Indies, are used for making acid drinks. **H. esculentus** Linnæus, the Okra or Gumbo, cosmopolitan in the tropics, is cultivated along the coast for its fruit which is much used in soups and as a vegetable.

3. **SIDA** Linnæus

Plant bristly pubescent; leaves cordate, long-petioled. 1. *S. urens*

Plant not bristly pubescent, or only slightly so; leaves generally not cordate, short-petioled:

Sepals not hairy. 2. *S. rhombifolia*

Sepals hairy:

Edge of sepals with many long, glistening hairs. 3. *S. glomerata*

Edge of sepals with few short hairs. 4. *S. acuta*

1. **Sida urens** Linnæus, Systema Naturæ ed. 10. 1145. 1759.

A slender, erect, hirsute herb with hairs of the foliage sufficiently stiff to penetrate the skin; leaves alternate, long-petioled, ovate-cordate, long-acuminate, serrate, 3-5 cm. long; flowers yellow, in dense clusters; fruit of 5 carpels, glabrous, 2-denticulate.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2896.

Range: African and American tropics.

2. **Sida rhombifolia** Linnæus, Species Plantarum 684. 1753.

An herb or shrub 1 m. high or less; leaves alternate, short-petioled, ovate to oblong, obtuse or acute at the apex, serrate, minutely stellate-tomentose beneath, 4-8 cm. long, .5-3 cm. broad; flowers yellow, small, solitary in the axils of the leaves, sepals gland-dotted; fruit of 10-12 carpels, subulate-beaked, 3-4 mm. long.

The plant is found in pastures where it is associated with ticks which are abundant where it grows. It is used in Mexico as a substitute for Chinese tea.

Matope, Cuyuni River, July 23, 1924, *Graham* 335; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1872; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2477; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3060.

Range: Common throughout the tropics.

3. **Sida glomerata** Cavanilles, Monadelphix Classis Dissertationes Decem 1: 18. pl. 2, f. 6. 1785. BROOMWEED, ESCOBILLA

Sida Berteriana Balbis, in DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 1: 460. 1824.

An herb with a woody base; leaves alternate, ovate-elliptic, about 5 cm. long, 1.5 cm. broad, unequally serrate; flowers white or yellow, in axillary or terminal racemes which are shortened into a round head intermixed with stipules and stipule-like bracts; fruit of 5 carpels, about 2 mm. long.

A mucilaginous juice from this plant is used as soap. As in other species of the genus, the branches are used for brooms.

Vicinity of Kartabo, August 3, 1924, *Graham* 411; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1911.

Range: American tropics.

4. **Sida acuta** Burmann, Flora Indica 147. 1768. WIREWEED

Sida carpinifolia Linnæus filius, Supplementum Plantarum 307. 1781.

Sida Balbisiana DeCandolle, Prodrômus Systematis Naturalis Regni Vegetabilis 1: 460. 1824.

An erect herb, stellate-pubescent or nearly glabrous; leaves in 2 vertical ranks, short-petioled, lanceolate to ovate, acute, serrate, obtuse at the base, 3-5 cm. long, .5-2 cm. broad; flowers small, white or pale yellow, open in the morning, closed in the afternoon.

The strong fibre of the stems is used in making rope and hammocks.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2464.

Range: One of the most abundant weeds of tropical America, occurring northward into Florida and Alabama.

Sida cordifolia Linnæus, Velvet Leaf, is reported by Beebe (1925) as a common, waist-high herb of jungle clearings near Kartabo.

78. BOMBACACEÆ. Bombax Family

1. BOMBAX Linnæus

1. **Bombax aquaticum** (Aublet) Schumann, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 3⁶: 62. 1890.

KONAHERI or WILD CACAO

Pachira aquatica Aublet, Histoire des Plantes de la Guiane Française 2: 726. pl. 291, 292. 1775.

A tree; leaves alternate, large, palmate; leaflets 5-9, elliptic-lanceolate, 10-20 cm. long; flowers large, axillary; petals linear, tomentose, greenish-white, 20 cm. long; stamens yellow-purple in a column divided above, slightly shorter than the petals; calyx about 4 cm. long, cup-shaped; fruit a large, 5-parted capsule.

The plant occurs in swamps or along the rivers' edges; the large seeds are roasted and eaten like chestnuts and the young leaves are also cooked and eaten.

Vicinity of Kartabo, July 6, 1924, *Graham* 163; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2412; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2615.

Range: American tropics.

Bombax insigne Schumann, the Konaheri-balli, is reported by British Empire Exhibition (1924) as an inhabitant of moist places in Georgetown.

Bombax pentandrum Linnæus (**Ceiba pentandra** (L.) Gærtner), the Silk-Cotton Tree listed by British Empire Exhibition (1924), is an enormous tree from which the Kapok of commerce is obtained, this being the wool-like or cotton-like fibre found within the fruit which is a large, coriaceous capsule.

79. STERCULIACEÆ. Chocolate Family

1. WALTHERIA Linnæus

1. **Waltheria americana** Linnæus, Species Plantarum 673. 1753.

VELVETWEED

Waltheria elliptica Cavanilles, Monadelphicæ Classis Dissertationes Decem 6: 316. 1788.

An herb or shrub 1-2 m. high or less, densely stellate-tomentose; leaves petioled, oblong to ovate, obtuse or rounded at the apex, crenate-dentate, 6-10 cm. long, 2-4 cm. broad; flowers yellow, in dense, sessile or peduncled, axillary clusters; fruit a 1-seeded capsule.

Vicinity of Kartabo, July 18, 1924, *Graham 290*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1979*.

Range: A common weed, cosmopolitan in the tropics.

Theobroma Cacao Linnæus, the Cacao or Chocolate Tree, a native of continental tropical America, is cultivated in the colony and is sparingly spontaneous.

80. DILLENACEÆ.

1. DAVILLA Vandelli

1. **Davilla aspera** (Aublet) Benoist, Bulletin de la Société Botanique de France 60: 392. 1913.

Tigarea aspera Aublet, Histoire des Plantes de la Guiane Française 2: 918. 1775.

A climbing shrub; leaves alternate, ovate-oblong to orbicular, rounded or retuse at the apex, up to 20 cm. in length; flowers yellow, in large, terminal panicles; two of the 5 sepals hardened, yellowish, about 7 mm. in diameter, enclosing the fruit.

The stems are used for making baskets. A native told the writer that the plant is called Cabanulla or Cabandulla and that the young cut bark is poisonous to the touch.

Vicinity of Kartabo, August 3, 1924, *Graham* 408; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1619.

Range: Guianas.

Curatella americana Linnæus, the Sandpaper Tree, has been reported from the colony by British Empire Exhibition (1924) especially in the open savannah country. It is a shrub or small tree, native to South and Central America, with large, thick, ovate to elliptic leaves containing silica, which are much used for sandpaper. The wood is valuable for fuel, charcoal and for cabinet work.

81. OCHNACEÆ.

Flowers in terminal panicles, fertile stamens usually more than 5; shrubs or trees:

Ovary 5-10-lobed; fruit a drupe. 1. *OURATEA*

Ovary 2-5-lobed; fruit a 1-seeded capsule. 2. *ELVASIA*

Flowers solitary, paired or in axillary panicles, fertile stamens 5; herbs.

3. *SAUVAGESIA*

1. OURATEA Aublet

1. **Ouratea Candollei** (Planchon) Engler, in Martius, *Flora Brasiliensis* 12²: 314. 1876.

Ouratea guianensis Aublet, *Histoire des Plantes de la Guiane Française* 1: 152. 1775.

Gomphia guyannensis Richard, *Actes de la Société d'Histoire Naturelle de Paris* 1: 168. 1792.

Gomphia Candollei Planchon, *London Journal of Botany* 6: 4. 1847.

A tree; leaves alternate, smooth, stiff, leathery, ovate-acuminate, 10-15 cm. long, 5-8 cm. broad; flowers yellow, in terminal racemes; fruit a drupe.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1669.

Range: American tropics.

2. ELVASIA DeCandolle

1. **Elvasia essequibensis** Engler, in Martius, *Flora Brasiliensis* 12²: 354. 1876.

A shrub or small tree; leaves alternate, smooth, leathery, oblong-elliptic, acuminate, almost woody in texture, with a prominent mid-

rib which is depressed above, 10-20 cm. long, 5-8 cm. broad; flowers small, yellow, in terminal, spreading panicles, with conspicuous, orange-colored anthers; fruit capsular.

Vicinity of Kartabo, July 5, 1924, *Graham* 153.

Range: American tropics.

3. SAUVAGESIA Linnæus

Leaves 1-3.5 cm. long; inflorescence not racemose.....1. *S. erecta*

Leaves 3-10 cm. long; inflorescence racemose.....2. *S. elata*

1. *Sauvagesia erecta* Linnæus, Species Plantarum 203. 1753.

An erect or decumbent; woody herb; leaves alternate, elliptic-lanceolate, serrulate, 1.5-3 cm. long, 4-10 mm. broad, the stipules long-fringed; flowers white to red, long-pedicelled, solitary or paired in the axils of the leaves; fruit a 3-valved capsule.

Matope, Cuyuni River, July 23, 1924, *Graham* 338; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1579; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1665; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1859; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1980; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2455; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2895; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2895; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2950.

Range: Native to American tropics, now found also in the African tropics.

2. *Sauvagesia elata* Benthams, Journal of Botany 4: 107. 1842.

A shrub; leaves alternate, lanceolate-elliptic, tapering at both ends, serrulate, 6-10 cm. long, 1-2 cm. broad, the stipules with long fringes; flowers in terminal and axillary racemes; fruit a 3-valved capsule.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2988; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2992.

Range: West Indies and the Guianas.

82. CARYOCARACEÆ.

1. CARYOCAR Linnæus

1. **Caryocar glabrum** (Aublet) Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 84. 1807. SAOUARI, SUWARROW-NUT

Saouari glabra Aublet, Histoire des Plantes de la Guiane Française 1: 599. pl. 241. 1775.

A tall tree; leaves opposite, trifoliate; leaflets ovate to elliptic, acuminate, slightly serrate, 10-12 cm. long, 3-5 cm. broad; flowers white, in terminal racemes; fruit an egg-sized drupe containing 4 nuts.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2930.

Range: Guianas.

Caryocar nuciferum Linnæus, the common Saouri, Suwarrow, Sawari or Butternut of the tropics, is a native of the colony and should occur within the Kartabo region. This tree has circular pockmarks on the bark and attains a height of 35 m. or more and produces valuable lumber used in ship building. The 4-celled fruits are 10-15 cm. in diameter and the red-brown, kidney-shaped nuts, embossed with coarse tubercles, taste like a combination of Brazil-nuts and chestnuts. **C. villosum** Persoon of Guiana and Brazil, is another tree of the genus possibly occurring in the region.

83. MARCGRAVIACEÆ. Marcgravia Family

Flowers not all fertile, the central sterile; stamens 12-40.....1. *MARCGRAVIA*
Flowers all fertile; stamens 3-5.....2. *SOUROUBEA*

1. MARCGRAVIA Linnæus

Peduncle not prolonged beyond the points of attachment of the pedicels; leaves 5-8 cm. broad, petiole 1-1.5 cm. long; racemes dark greenish-purple; fruit 10 mm. in diameter.....1. *M. purpurea*

Peduncle prolonged beyond the points of attachment of the pedicels; leaves 3-5 cm. broad, petiole 3-5 mm. long; racemes yellow or brownish-green; fruit 2 cm. in diameter.....2. *M. cuyuniensis*

1. **Marcgravia purpurea** I. W. Bailey, American Journal of Botany 9: 378. 1922.

A scandent, epiphytic shrub; leaves alternate, oblong-elliptic, attenuate-acuminate, 12-19 cm. long, 5-8 cm. broad; flowers in

pendulous, umbelliform racemes; at the apex of the peduncle are inserted sac-like nectaries 5-7 cm. long; fruit small, reddish, globose, about 10 mm. in diameter.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1633; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2689.

Range: British Guiana.

2. ***Marcgravia cuyuniensis*** I. W. Bailey, American Journal of Botany 9: 377. 1922.

A scandent, epiphytic shrub; leaves alternate, leathery, elliptic-oblong, acuminate, 10-16 cm. long, 3-5 cm. broad; flowers yellowish or brownish-green, in pendulous, terminal, umbelliform racemes; at the apex of the peduncle are inserted sac-like nectaries 6-8 cm. long; fruit large, reddish, globose, 2 cm. in diameter.

Sterile runners with clasping roots and small distichous leaves are frequently produced in this species, and even more so in the preceding one, *M. purpurea*, and become conspicuous on tree trunks, while the raceme-bearing branches are pendulous with large leaves.

In *M. cuyuniensis* the leaves are nearly sessile and borne on a straight shoot, while in *M. purpurea* the leaves are strongly petioled and borne on a somewhat zigzag axis.

The genus *Marcgravia* in the Kartabo region is treated by Bailey (1922) in an article in which he shows that the flowers are not pollinated by hummingbirds, as was for sometime supposed, but are self-fertile or autogamous.

Vicinity of Kartabo, July 31, 1924, *Graham* 561.

Range: British Guiana.

2. SOUROUBEA Aublet

1. ***Souroubea guianensis*** Aublet, Histoire des Plantes de la Guiane Française 1: 244. pl. 97. 1775.

Ruyschia souroubea Swartz, Prodomus Descriptionum Vegetabilium Indiæ Occidentalis 50. 1788.

Ruyschia guianensis Vittmann, Summa Plantarum quæ Hactenus Innotuerunt 2: 250. 1789.

An epiphytic shrub pendent from trees or scandent; leaves alternate, leathery, oblong to obovate, 10-15 cm. long, 3-5 cm. broad; flowers whitish, in terminal racemes, the spur of the bract conspicuously elongate, 2-cleft at the base; fruit globose and fleshy.

Vicinity of Kartabo, July 21, 1924, *Graham* 309; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2414; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2695.

Range: Guianas.

84. TERNSTRÆMIACEÆ. Tea Family

1. TERNSTRÆMIA Mutis

1. ***Ternstroemia punctata*** Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 81. 1788.

Taonabo punctata Aublet, *Histoire des Plantes de la Guiane Française* 1: 571. 1775.

A shrub; leaves alternate, obovate, leathery, cuneate at the base, 5-8 cm. long, 2.5 cm. broad; flowers solitary or few in the axils of the leaves; fruit pointed, coriaceous, indehiscent.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2660.

Range: Guianas.

85. GUTTIFERÆ. St. John's Wort Family

Stamens hypogynous or more or less perigynous; disk none but separate glands or a gynophore sometimes present (Hypericaceæ):

Stamens many, united at the base; ovary 3-loculed, each locule with 1-3 pendent seeds. 1. *CARAIPA*

Stamens numerous, arranged in 5 fascicles; ovary 5-loculed, each locule with 1-many ascending seeds. 2. *VISMIA*

Stamens hypogynous, but inserted on the base or on the surface of a disk, or sometimes somewhat perigynous, being inserted on a concave disk-like receptacle (Clusiaceæ):

Cells of the ovary with 2-many seeds:

Stamens in the male flowers many, almost free, almost all or only the lower united; seeds many. 3. *CLUSIA*

Stamens in the male flowers 5-10, united at the base, the anthers radiating horizontally from the apex of a column; seeds 2-4. 4. *RENGIFA*

Cells of the ovary with 1 seed. 5. *TOVOMITA*

1. *CARAIPA* Aublet

Inflorescence a leafless, axillary cluster. 1. *C. Richardiana*

Inflorescence a leafy panicle. 2. *C. fasciculata*

1. **Caraipa Richardiana** Cambessedes, Mémoires du Muséum d'Histoire Naturelle, Paris 16: 414. 1828.

A shrub; leaves alternate, oblong, smooth, short-acuminate, 8-20 cm. long, 3-5 cm. broad; flowers white or rose-colored in axillary corymbs; fruit a 3-valved capsule.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1597; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1626.

Range: Guianas.

2. **Caraipa fasciculata** Cambessedes, Mémoires du Muséum d'Histoire Naturelles, Paris 16: 416. 1828.

A woody shrub; leaves alternate, short-petioled, oblong-lanceolate to elliptic, slightly acuminate, up to 15 cm. long, 5 cm. broad; flowers in rather dense, leafy, axillary or terminal cymose panicles; fruit a 3-valved capsule.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2740.

Range: Guianas.

2. VISMIA Vandelli

Leaves shallowly cordate at the base.....1. *V. latifolia*
Leaves acute to cuneate at the base:

Leaves tomentose beneath.....2. *V. guianensis*
Leaves smooth beneath.....3. *V. cayennensis*

1. **Vismia latifolia** (Aublet) Choisy, Prodrômus d'une Monographie de la Famille des Hypericinus, Geneve 36. 1821.

Hypericum latifolium Aublet, Histoire des Plantes de la Guiane Française 2: 787. 1775.

Caopia latifolia O. Kuntze, Revisio Generum Plantarum 59. 1891.

A tree 6 m. high; leaves opposite, ovate, shallowly cordate at the base, acuminate at the apex, 10-20 cm. long, 4-10 cm. broad; flowers in terminal or axillary cymes, the petals black-dotted below, densely villose above; fruit a many-seeded berry.

Vicinity of Kartabo, July 18, 1924, *Graham* 292.

Range: Guianas.

2. **Vismia guianensis** (Aublet) DeCandolle, Prodrômus Systematis Naturalis Regni Vegetabilis 1: 542. 1824.

Hypericum guianense Aublet, Histoire des Plantes de la Guiane Française 2: 784. pl. 311. 1775.

Vismia guttifera var. *guianensis* Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 86. 1807.

A tree; leaves opposite, ovate-elliptic, long-acuminate, generally broader below the middle, 10-15 cm. long, 3-6 cm. broad; flowers in a loose, terminal or axillary cyme, the petals pale brown, densely villous above; fruit a many-seeded, ovoid berry, 5-10 mm. long.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham 147*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 2011*; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2705*.

Range: American tropics.

3. **Vismia cayennensis** Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 86. 1807.

Caopia cayennensis O. Kuntze, Revisio Generum Plantarum 1: 58. 1891.

A low tree or shrub; leaves opposite, elliptic-lanceolate, attenuate at the apex, cuneate at the base, 6-12 cm. long, 1.5-4 cm. broad; flowers in few-flowered, axillary or terminal cymes; fruit a many-seeded berry.

Along Cuyuni River, near Camaria road, July 23, 1924, *Graham 324*.

Range: West Indies to the Guianas and Brazil.

Vismia ferruginea Humbolt, Bonpland and Kunth, the Blood Leaf, is reported by Beebe (1925) in the clearings with *V. guianensis*. Its common name comes from the fact that the sap turns red when exposed to the air.

3. **CLUSIA** Linnæus

1. **Clusia Martini** Sagot, from Engler, in Martius, Flora Brasiliensis 12¹: 425. 1888. WILD FIG, BALSAM TREE

Clusia palmicida L. C. Richard, from Planchon and Triana, Annales des Sciences Naturelles, IV. 13: 326. 1860.

An epiphytic vine; leaves opposite, obovate, leathery, rounded at the apex, cuneate at the base, long-petioled, 10-15 cm. long, 4-8 cm. broad; flowers about 7 cm. in diameter; fruit a leathery capsule, splitting when ripe, the segments radiating and reflexed, exposing the numerous arillate seeds.

The seeds of this genus are often carried by birds to the branches of other trees where they germinate and grow, eventually strangling the host, hence they are often termed Strangling Figs (*See Plate XVIII*).

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1599*.

Range: Guianas.

4. RENGIFA Poeppig and Endlicher

1. **Rengifa acuminata** Planchon and Triana, Annales des Sciences Naturelles, IV. 14: 243. 1860.

A shrub; leaves opposite, elliptic, attenuate at the apex, cuneate at the base, 6-10 cm. long, 2-4 cm. broad; flowers small, in compound, terminal clusters; fruit a 5-valved capsule.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2730.

Range: Guianas.

5. TOVOMITA Aublet

1. **Tovomita Schomburgkii** Planchon and Triana, Annales des Sciences Naturelles IV. 14: 274. 1860.

A shrub or tree; leaves opposite, ovate-elliptic, 6-12 cm. long, 3-6 cm. broad, glabrous, petioled; flowers in terminal, corymbiform cymes; fruit a 4-valved capsule.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2733.

Range: Guianas.

Moronobea coccinea Aublet, the Manni, is a large tree with elongate, leathery leaves and conspicuous crimson flowers which is reported by British Empire Exhibition (1924) to inhabit the swamps of the North East District.

Rheedia floribunda Planchon and Triana, is reported by Hingston (1932). He states it supplied the members of their expedition with a green-yellow fruit from a tree 15 m. high (40-50 feet).

Symphonia globulifera Linnaeus filius, the Manni-balli, is a tree of the Kartabo forest. The wood is soft, greenish brown, and of moderate value. Hingston (1932) says that the bark is yellow with brown pits and that the tree possesses both stilt-like roots from the trunk and aerial roots which loop up into the air at intervals from the ground.

86. VIOLACEÆ. Violet Family

- Leaves opposite; corolla regular.....1. *RINOREA*
 Leaves alternate; corolla somewhat irregular.....2. *PAYPAYROLA*

I. RINOREA Aublet

1. **Rinorea Passoura** (DeCandolle) O. Kuntze, *Revisio Generum Plantarum* 1: 42. 1891.

Passoura guianensis Aublet, *Histoire des Plantes de la Guiane Française* 1: 235. pl. 93. 1775.

Conohoria Passoura DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 1: 312. 1824.

A shrub or small tree; leaves opposite, ovate-elliptic to obovate, irregularly dentate, tapering into a long acuminate tip, 10-20 cm. long, 5-8 cm. broad; flowers sessile or sub-sessile in a loose, axillary or terminal spike-like raceme; fruit a woody capsule.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2991.

Range Brazil and the Guianas.

2. PAYPAYROLA Aublet

1. **Paypayrola guianensis** Aublet, *Histoire des Plantes de la Guiane Française* 1: 249. 1775.

A shrub or small tree; leaves alternate, elliptic-lanceolate, bluntly-acuminate, cuneate at the base, 10-20 cm. long, 4-7 cm. broad; flowers in short, axillary spike-like racemes; fruit an ovoid capsule.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2914.

Range: Guianas.

Paypayrola longifolia Tulasne Hingston (1932) reports as a cauli-florus species of the forest with bluebell-like flowers.

87. FLACOURTIACEÆ. Flacourtia Family

Flowers in terminal panicles.....1. *BANARA*

Flowers in lateral or axillary clusters, corymbs, spikes or racemes:

Disk of the flower without staminodia-like appendages; leaves entire.

2. *RYANIA*

Disk with staminodia-like appendages; leaves serrate.....3. *CASEARIA*

I. BANARA Aublet

1. **Banara guianensis** Aublet, *Histoire des Plantes de la Guiane Française* 1: 548. 1775.

A shrub or small tree about 8 m. high; leaves alternate, oblong to ovate, acuminate, serrate, densely pubescent beneath, 6-15 cm. long,

3-5 cm. broad; flowers small, white, in terminal racemes; fruit a spherical berry 8 mm. in diameter.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2031.

Range: Guianas.

2. RYANIA Vahl

1. **Ryania speciosa** Vahl, *Eclogæ Americana* 1: 51. pl. 9. 1796.

Patrisia pyrifera L. C. Richard, *Actes de la Société d'Histoire Naturelle de Paris* 1: 110. 1792.

A small tree with sparse, stellate pubescence; leaves alternate, entire, oblong, 15-20 cm. long, 6-10 cm. broad; flowers solitary, short-stalked, axillary, 3 cm. long; fruit a tuberculate, berry-like capsule 2 cm. in diameter.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2028; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2443.

Range: American tropics.

3. CASEARIA Jacquin

Leaves ovate to ovate-elliptic, glabrous or only slightly pubescent beneath:

Leaves leathery, glossy above, entire or irregularly serrate, slightly pubescent on the veins beneath.....1. *C. densiflora*

Leaves not leathery, not glossy above, distinctly and regularly serrate, glabrous beneath, or nearly so:

Flowers sessile or subsessile.....2. *C. Fockeana*

Flowers pedicellate.....3. *C. guianensis*

Leaves oblong-lanceolate, densely tomentose beneath and on the veins above.

4. *C. Rusbyana*

1. **Casearia densiflora** Benthām, in Hooker, *Journal of Botany* 4: 113. 1842.

A shrub or small tree; leaves alternate, ovate to elliptic, entire or slightly serrate, 4-12 cm. long, 2-5 cm. broad; flowers sessile in the axils of the leaves; fruit capsular.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2673.

Range: Guianas.

2. **Casearia Fockeana** Miquel, *Annales des Sciences Naturelles* III. 1: 39. 1844.

A shrub or small tree; leaves oblong-elliptic, crenate-serrate, 8-15 cm. long, 3-5 cm. broad; flowers sessile or nearly so, axillary; fruit capsular.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2449.

Range: Guianas.

3. **Casearia guianensis** (Aublet) Urban, *Symbolæ Antillanæ* 3: 322. 1902; not *C. guianensis* F. R. Johnston, 1909.

Iroucana guianensis Aublet, *Histoire des Plantes de la Guiane François* 1: 329. 1775.

A shrub 3-4 m. high or a tree up to 10 m.; leaves alternate, ovate-elliptic, crenate-serrate, 6-15 cm. long, 2-6 cm. broad; flowers white to greenish, in axillary clusters; fruit a small capsule, yellow.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1998.

Range: West Indies, Central and South America.

4. **Casearia Rusbyana** Briquet, *Annuaire du Conservatoire et du Jardin botaniques*, Geneva 2: 73. 1898.

A shrub or tree; leaves alternate, oblong-lanceolate, truncate at the base, acuminate at the apex, finely serrate on the margin, 8-15 cm. long, 3-6 cm. broad, short petioled; flowers nearly sessile, in axillary clusters; fruit capsular.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1649.

Range: Northern South America.

88. PASSIFLORACEÆ. Passion-flower Family

1. PASSIFLORA Linnæus

- a. Leaves ovate, apex not lobed or truncate:
 - b. Leaves irregularly but distinctly serrate. 1. *P. coccinea*
 - bb. Leaves entire, or irregularly notched or lobed:
 - c. Stipules leaf-like, 1 cm. or more in length, tipped with a long bristle. 2. *P. retipetala*
 - cc. Stipules not leaf-like:
 - d. Flowers small, 2 cm. broad. 3. *P. auriculata*
 - dd. Flowers large, 5-10 cm. broad:
 - e. Perianth parts oblong, obtuse. 4. *P. nitida*
 - ee. Perianth parts tapering from a broad base. 5. *P. Gleasoni*
 - a. Leaves not ovate, apex lobed or truncate:
 - b. Leaves broadly truncate to notched; plant puberulent. 6. *P. vespertilio*
 - bb. Leaves 3-lobed; plant with spreading hairs. 7. *P. hispida*

1. **Passiflora coccinea** Aublet, *Histoire des Plantes de la Guiane Françoise* 2: 828. 1775.

A robust vine with well-developed tendrils; leaves alternate, ovate-elliptic, broadest at the base, up to 15 cm. long, serrate-dentate, brown-tomentose beneath; bracts large, showy, brilliant red; fruit a many-seeded berry.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 128; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2701; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2918.

Range: Guianas.

2. **Passiflora retipetala** Masters, *Kew Bulletin* 1893: 12. 1893.

A slender vine with rather delicate tendrils; leaves alternate, triangular-ovate, entire, about 8 cm. long, petiole several glandular; stipules leaf-like, slender-tipped at the apex; flower about 4 cm. in diameter; fruit a many-seeded berry.

Graham 126 was found crawling over low clearing growth.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 126.

Range: Guianas.

3. **Passiflora auriculata** Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 2: 131. 1817.

A nearly glabrous, slender vine, climbing by slender tendrils; leaves alternate, triangular-ovate, entire, leathery, about 12 cm. long; flower about 2 cm. in diameter; fruit a many-seeded berry.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2632.

Range: Venezuela and the Guianas.

4. **Passiflora nitida** Humbolt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 2: 130. 1817.

A robust, glabrous vine with strong tendrils; leaves alternate, oblong-ovate, 12-18 cm. long, 7-10 cm. broad; flowers 8-10 cm. in diameter; fruit a many-seeded berry.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1625.

Range: Venezuela and the Guianas.

5. **Passiflora Gleasoni** Killip, *Journal of the Washington Academy of Sciences* 14: 112. 1924.

A rather coarse, glabrous vine with strong tendrils; leaves ovate-oblong, about 15 cm. long and half as broad; flowers about 8 cm. in diameter; fruit a many-seeded berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2963.

Range: British Guiana.

6. ***Passiflora vesperitilio*** Linnæus, Species Plantarum 957. 1753.

A delicate, puberulent vine with very slender tendrils; leaves semi-circular in outline, about 6 cm. long, twice as broad, strikingly truncate to notched at the apex; flowers about 5 cm. broad; fruit a many-seeded berry.

Vicinity of Kartabo, July 1924, *Graham* 96.

Range: American tropics.

7. ***Passiflora hispida*** DeCandolle, from Planchon and Triana, Annales des Sciences Naturelles, Botanique V. 17: 172. 1873.

A rather slender, pilose vine with strong tendrils; leaves 3-lobed, cordate at the base, acuminate at the apex, about 8 cm. long; bracts of the large flowers bipinnatisect, the ultimate segment gland-tipped; fruit a many-seeded berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3049.

Range: Throughout the American tropics.

89. CARICACEÆ. Papaya Family

I. CARICA Linnæus

1. ***Carica papaya*** Linnæus, Species Plantarum 1036. 1753.

PAPAYA

A shrub-like plant with a simple, thick, pale-green, generally hollow, stem, 2-8 m. high, suggesting a cabbage stalk; leaves long-stalked, mostly palmately 7-lobed, clustered at the top of the stem, 50 cm. broad or larger, glabrous; flowers fragrant, diœcious, pale-yellow, the male in slender panicles; fruit a fleshy berry, yellow and shaped like a roughly angled melon up to 30 cm. in length and half as thick.

The fruit is generally eaten raw, and is used in preserves and pies. The sap of the plant, and particularly the fruit, contains the enzyme, papain, which resembles animal pepsin in its digestive action and is used in treating dyspepsia. Tough meat is sometimes wrapped in the leaves where it becomes tender, and the leaves are boiled with meat.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 226; along Camaria road, Cuyuni River, July 30, 1924, *Graham* 377; vicinity of

Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1871.

Range: Native to the American tropics and now cultivated throughout the tropics for its fruit.

90. LYTHRACEÆ. Loosestrife Family

1. CUPHEA Adanson

1. **Cuphea speciosa** (A. Anderson) O. Kuntze, *Revisio Generum Plantarum* 3: 96. 1898.

Melvilla speciosa A. Anderson, *Journal of Arts and Sciences* 25: 207. 1807.

Cuphea Melvilla Lindley, *Botanical Register* 10: pl. 852. 1824.

A delicate shrub 3 m. high or less; leaves opposite, elliptic, 8-12 cm. long, 2-4 cm. broad; flowers in a short, terminal, spike-like raceme, tubular, red with a yellow tip, 3 cm. long, 6 mm. broad, the stamens slightly exserted; fruit a capsule, bursting laterally.

Graham 105 was collected in a second growth jungle thicket.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham* 105.

Range: Widely distributed in South America.

Lagerstroemia indica Linnaeus, the Crape Myrtle or Queen of Flowers, a native of Asia, is a common shrub in Georgetown, according to Hitchcock (1921). It is a glabrous shrub or small tree with showy white, pink or purple flowers which have long-clawed, crinkled petals.

The same authority lists **L. speciosa** Persoon, the King of Flowers, native to Asiatic tropics, as a large tree with conspicuous rose to purple flowers, common in Georgetown parks and gardens.

91. LECYTHIDACEÆ. Monkey Pot Family

Bertholletia excelsa Humbolt and Bonpland, the Brazil-nut, is also to be found. It is a great tree up to 50 m. high with alternate, oblong-lanceolate leaves often 6 dm. long. The fruit is hard, woody, about 15 cm. in diameter, containing 18-24 triangular seeds, the Brazil-nuts of commerce.

Couroupita guianensis Aublet, the well-known Cannon-Ball Tree, is a native of the region with sweet-scented flowers and brown cannon-ball-like fruits attached to the trunk.

Lecythis grandiflora Aublet, Wadaduri Bark or Monkey Pot, is reported by Zon and Sparhawk (1923) as a native timber tree with light red or orange wood, close-grained and strong, stiff and very

hard, which is used for building, furniture, turnery spokes and staves. Other species of *Lecythis* are among the most important of the colony's timber trees and are known as Kakeralli. They have hard, very strong, fine-grained, brown wood used for construction, wharves, piles, and mine timbers and said to resist teredo attacks. The bark is black or mottled.

92. RHIZOPHORACEÆ. Mangrove Family

Anthers 8, subsessile; calyx 4-parted; fruit 1-seeded; leaves thick, obtuse.

1. RHIZOPHORA

Anthers 15-30, on filaments; calyx campanulate, 4-5-lobed; fruit 3-seeded; leaves thin, acuminate.....2. CASSIPOUREA

1. RHIZOPHORA Linnæus

1. *Rhizophora Mangle* Linnæus, Species Plantarum 443. 1753.

(See Plate VII).

MANGROVE, MANGLE

A glabrous tree sometimes reaching a height of 25 m.; leaves opposite, elliptic to obovate, leathery, entire, dark green; flowers in few-flowered clusters, the pale yellow petals linear; fruit leathery, indehiscent, about 2.5 cm. long, the radicle protruding as a narrowly clavate, pendent body.

The pendulous fruit germinates on the tree, the long, cigar-shaped radicle striking deep into the mud when it falls. The interlacing, arched, prop-roots, which are covered at high tide, act as land builders, and in some regions, where oysters grow on the roots, the story is current that "oysters grow on trees." The bark contains 20-30 per cent tannin and the wood is hard, heavy, fine-grained and used in various ways, particularly in the making of charcoal. It occurs along the sea shore and up the rivers, a good growth of it existing along the Cuyuni River shore in front of the Kartabo laboratory.

Georgetown Botanic Garden, August 10, 1924, *Graham* 560.

Range: In tidal swamps throughout tropical and subtropical America; it also occurs in Africa.

2. CASSIPOUREA Aublet

1. *Cassipourea guianensis* Aublet, Histoire des Plantes de la Guiane Française 1: 529. 1775.

A shrub; leaves opposite, ovate-elliptic, acuminate, 10-15 cm. long, 3-6 cm. broad; flowers white, in sessile, axillary clusters; fruit a 3-valved capsule.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2420; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2425; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2624; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3063; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2463.

Range: South America.

93. COMBRETACEÆ. Caterpillar-flower Family

Leaves alternate; petals none.....1. *TERMINALIA*
 Leaves opposite; petals present.....2. *COMBRETUM*

1. *TERMINALIA* Linnæus

1. ***Terminalia obovata*** (Ruiz and Pavon) Steudal, Nomenclator Botanicus ed. 2. 2: 668. 1841.

Gimbernatea obovata Ruiz and Pavon, Systema Vegetabilium Floræ Peruvianæ et Chilensis 274. 1798.

A tree; leaves alternate, obovate, bluntly acuminate, 5-10 cm. long, 2-4 cm. broad; flowers in slender, axillary spikes; fruit scale-like, two-winged.

Graham 355 was 10 m. high and found on the river bank.

Vicinity of Kartabo, July 1924, *Graham* 355.

Range: Peru and the Guianas.

Terminalia Catappa Linnæus, the Indian Almond, a tall tree with alternate leaves and flowers in slender, axillary spikes, is native to the old world but Grisebach (1864) reports it naturalized in Guiana. The seeds are edible, like filberts.

2. *COMBRETUM* Linnæus

Flowers in dense, one-sided, spike-like racemes; leaves ovate.....1. *C. Aubletii*
 Flowers in loose, spreading racemes; leaves more or less spherical.

2. *C. brunnescens*

1. ***Combretum Aubletii*** DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis 1: 19. 1824.

A woody climber; leaves opposite, ovate-elliptic, acuminate, 8-12 cm. long, 3-7 cm. broad; flowers in long, terminal, generally one-sided, spike-like racemes; fruit a winged achene, ovate-oblong.

Vicinity of Kartabo, July 27, 1924, *Graham 95*; vicinity of Kartabo, July 5, 1924, *Graham 174*.

Range: Guianas.

2. **Combretum brunnescens** Gleason, Bulletin of the Torrey Botanical Club 53: 291. 1926.

A robust, climbing shrub; leaves opposite, ovate to obovate, leathery, rounded at the apex or abruptly acuminate, 6-12 cm. long, 5-8 cm. broad; flowers in loose, spreading, axillary or terminal, compound racemes; fruit 4-angled, winged, about 2 cm. long.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1947*.

Range: British Guiana.

Combretum laxum Læfing, native of the American tropics, is reported by Beebe (1925) along the river shore near Kartabo. It is a woody vine with spikes of bright red and yellow flowers and opposite, ovate-oblong or elliptic leaves. Grisebach (1864) considers this species synonymous with *C. Aubletii* DeCandolle.

Cacoucia coccinea Aublet reported by British Empire Exhibition (1924) bears terminal racemes of red flowers. It is a scandent shrub with entire leaves, common along the rivers and is native to the Guianas.

Laguncularia racemosa Gærtner, the White Mangrove, a native of continental America and Africa, is reported by Hitchcock (1921). It is a shrub or tree with leathery, oblong-ovate, obtuse leaves 4-8 cm. long, the petiole with 2 conspicuous glands at the apex and small flowers in clustered spikes. The leathery, reddish fruit is 1.5 cm. long and whitish-pubescent.

94. MYRTACEÆ. Myrtle Family

Inflorescence not paniculate; ovary horse-shoe-shaped or spirally curved; hypocotyl generally thicker than the small cotyledons:

Calyx limb not closed in the bud, the lobes imbricate, persistent.

1. CALYCOLPUS

Calyx limb closed in the bud, or open but deciduous in age. 2. *PSIDIUM*

Inflorescence paniculate; ovary and especially the leaf-like cotyledons folded in wrinkles; hypocotyl and cotyledons equal:

Sepals free in the bud, or only united below; leaves narrowly ovate to elliptic, long attenuate at the apex. 3. *MYRCIA*

Sepals united in the bud, splitting open as the bud expands; leaves broadly ovate, obtuse at the apex. 4. *MARLIERIA*

1. CALYCOLPUS Berg

Pedice! short, 5-15 mm. long; marginal leaf vein not distinct. 1. *C. Kegelianus*
 Pedice! long, 2-5 cm. long, marginal leaf vein distinct. 2. *C. glaber*

1. **Calycolpus Kegelianus** Berg, Linnæa 27: 381. 1856.

A tree; leaves opposite, ovate-elliptic, acuminate, 5-8 cm. long, 2-5 cm. broad; flowers usually solitary, about 1.5 cm. broad, in the axils of the leaves; fruit a several-seeded berry.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2649.

Range: Guianas.

2. **Calycolpus glaber** (Benthani) Berg, Linnæa 27: 379. 1856; in Martius, Flora Brasiliensis 14¹: 411. 1857.

Campomanesia glabra Benthani, in Hooker, Journal of Botany 2: 319. 1840.

A tree; leaves opposite, ovate to elliptic, acuminate, 8-12 cm. long, 3-6 cm. broad; flowers white, solitary or clustered in the axils of the leaves, long-peduncled, about 4 cm. broad; fruit a many-seeded berry, surmounted by the persistent, foliaceous calyx lobes.

Vicinity of Kartabo, July 5, 1924, *Graham* 157; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1867; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2721.

Range: Peru and the Guianas.

2. PSIDIUM Linnaeus

1. **Psidium guajava** Linnaeus, Species Plantarum 476. 1753. GUAVA

A shrub or small tree with scaly, pale brown bark; the young twigs and under surfaces of the leaves provided with silky, appressed hairs and minute, glandular dots; leaves opposite, elliptic to oblong, 5-12 cm. long, 3-5 cm. broad, acute or obtuse at the apex; flowers solitary or in 3's on axillary peduncles; fruit yellow, pear-shaped or globose with yellow or red pulp, 3-6 cm. in diameter.

The fruit of this plant is much used for making preserves and fine jellies.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2928.

Range: Native to the American tropics, now cultivated throughout the world.

Psidium fluviatile Richard, the Water Guava shrub, is reported by Beebe (1925) as a feature of rocky rapids in the rivers above Kartabo.

3. MYRCIA DeCandolle

1. **Myrcia sylvatica** (Meyer) DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 244. 1828.

Myrtus sylvatica Meyer, *Primitiæ Floræ Essequibænsis* 191. 1818.

A tree; leaves opposite, small, ovate-elliptic, tapering from below the middle to a slender apex, 3-5 cm. long, .5-2 cm. broad; flowers white, small, in axillary cymes; fruit a black berry.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1645; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2663; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2669.

Range: Guianas.

4. MARLIEREA Cambessedes

1. **Marlierea obtusa** Berg, *Linnaea* 27: 15. 1854.

A tree; leaves opposite, sessile, broadly ovate to elliptic, sometimes orbicular, 5-10 cm. long, 3-5 cm. broad; flowers white or yellow, in terminal, spreading cymes; fruit a small berry, crowned with the calyx lobes.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2007.

Range: Guianas.

95. MELASTOMACEÆ. Meadow Beauty Family

- a. Fruit capsular; stamens usually unequal:
 - b. Seed not straight, helicoid or cochleate; herbs, rarely suffrutescent:
 - c. Stamens alike or mostly alike:
 - d. Ovary bristly at the apex.....1. *PTEROLEPIS*
 - dd. Ovary not bristly at the apex:
 - e. Connective definitely prolonged below the anther, without appendages; capsule 2-4 valved.....2. *COMOLIA*
 - ee. Connective not at all or only shortly prolonged below the anther, with 2 conspicuous appendages; capsule rupturing irregularly.
 - 3. *ACIOTIS*
 - cc. Stamens very unequal:
 - d. Ovary 2-4 loculed, mostly glabrous.....4. *NEPSERA*
 - dd. Ovary 5-loculed, the apex downy or bristly.....5. *DESMOSCELIS*
 - bb. Seed straight, oblong or ovoid; mostly shrubs, often climbing:
 - c. Appendages of the connective on the inner (ventral) side.
 - 6. *RYNCHANThERA*

cc. Appendages of the connective on the outer (dorsal) side.

7. *ADELOBOTRYS*

aa. Fruit berry-like or leathery, rupturing unequally; stamens usually equal:

b. Inflorescence terminal:

c. Petals acute; anthers linear or elongate.....8. *LEANDRA*

cc. Petals obtuse; anthers various:

d. Leaves generally with 2-lobed, bladder-like swellings (formicaria) at the base.....9. *TOCOCA*

dd. Leaves without swellings (formicaria) at the base.....10. *MICONIA*

bb. Inflorescence lateral or axillary:

c. Plants decidedly pubescent throughout.....11. *CLIDEMIA*

cc. Plants glabrous or nearly so, pubescent only on the leaves beneath:

da. Anthers short, thick, and rounded, 2-pored, more or less in a ring; ovaries 8-15-celled.....12. *BELLUCIA*

dd. Anthers beaked, opening with a single pore, distinct and separate; ovaries 5-6-celled.....13. *HENRIETTEA*

I. *PTEROLEPIS* Miquel

1. *Pterolepis glomerata* (Rottbœll) Miquel, *Commentarii Phytographici* 78. 1840.

Rhexia glomerata Rottbœll, *Descriptionum Plantarum Rariorum* 8. pl. 4. 1776.

A hairy, woody herb; leaves opposite, elliptic, entire, 3-nerved, 2-4 cm. long, .5-2 cm. broad; flowers in terminal panicles or clustered in the leaf-axils, 4-8-merous; fruit capsular, included in the calyx tube, provided with branched hairs.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1592.

Range: Tropical South America.

2. *COMOLIA* DeCandolle

1. *Comolia villosa* (Aublet) Triana, *Transactions of the Linnæan Society* 28: 37. 1871.

Melastoma villosum Aublet, *Histoire des Plantes de la Guiane Française* 1: 428. pl. 168. 1775.

A hairy, glandular herb; leaves opposite, small, ovate, serrate, mostly 3-nerved, about 1-2 cm. long, nearly as broad; flowers purple, peduncled, 4-merous, solitary or few in axillary clusters; fruit capsular, included in the calyx tube, pubescent with glandular hairs.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2656.

Range: Guianas and Venezuela.

3. ACIOTIS D. Don

Stem and leaves pubescent; leaves rounded to subcordate at the base:

Inflorescence compact; connective of anthers only slightly prolonged at the base.

1. *A. dysophylla*

Inflorescence loosely spreading; connective of anthers distinctly prolonged at the base.....2. *A. laxa*

Stem and leaves glabrous; leaves acute or obtuse to cuneate at the base:

Leaves broadly obtuse to rounded at the base; connective simple, slightly expanded toward the base.....3. *A. purpurascens*

Leaves tapering at the base; connective with a short, triangular tooth on each side near the middle.....4. *A. fragilis*

1. ***Aciotis dysophylla*** (Benth) Triana, Transactions of the Linnæan Society **28**: 52. 1871.

Spennera dysophylla Benth, in Hooker, Journal of Botany **2**: 296. 1840.

A hairy, woody herb; leaves opposite, 5-nerved, ovate, serrulate, hairy, 4-6 cm. long, 2-4 cm. broad; flowers small, 4-merous, in terminal panicles; fruit capsular, included in the calyx tube, pubescent and sparsely glandular.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1573.

Range: Northern South America.

2. ***Aciotis laxa*** (L. C. Richard) Cogniaux, in Martius, Flora Brasiliensis **14**³: 476. 1885.

Melastoma laxum Richard, in DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis **3**: 116. 1828.

Aciotis indecora Triana, Transactions of the Linnæan Society **28**: 52. 1871.

A somewhat hairy, viscid, woody herb; leaves opposite, broadly ovate-acuminate, minutely serrulate, long-petioled, cordate at the base, 3-15 cm. long, 2-6 cm. broad, mostly 5-nerved; flowers small, 4-merous, in terminal freely branched panicles; fruit capsular, included in the calyx tube, somewhat glandular pubescent, the calyx lobes very short.

Graham 132 was collected in a moist depression.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 132; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2971; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2987.

Range: Brazil and the Guianas.

3. **Aciotis purpurascens** (Aublet) Triana, Transactions of the Linnæan Society **28**: 52. 1871.

Melastoma purpurascens Aublet, Histoire des Plantes de la Guiane Française **1**: 402. 1775.

Melastoma purpureum Willdenow, Species Plantarum **2**: 590. 1799.

A nearly glabrous, woody, square-stemmed herb; leaves opposite, ovate-elliptic, attenuate at the apex, serrate, 5-nerved, 6-12 cm. long, 2.5-4 cm. broad; flowers pink, 4-merous, in slender, terminal, freely-branched panicles; fruit capsular, included in the calyx tube, glabrous.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1920; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2936.

Range: American tropics.

4. **Aciotis fragilis** (Richard) Cogniaux, in Martius, Flora Brasiliensis, **14**³: 475. 1885.

Melastoma fragile Richard, in DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis **3**: 115. 1828.

A glabrous, woody herb; leaves opposite, elliptic, tapering at both ends, minutely serrulate, 3-5-nerved, 8-15 cm. long, 3-5 cm. broad; flowers small, 4-merous, in terminal, freely branched panicles; fruit capsular, included in the calyx tube, glabrous.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2986.

Range: Guianas.

4. NEPSERA Naudin

1. **Nepsera aquatica** (Aublet) Naudin, Annales des Sciences Naturelles, Botanique III. **13**: 28. 1849.

Melastoma aquaticum Aublet, Histoire des Plantes de la Guiane Française **1**: 430. pl. 169. 1775.

An herb or low, slender shrub about 1 m. high; leaves opposite, membranous, ovate, minutely serrulate, 2-5 cm. long, 1-2 cm. broad, 5-nerved; flowers white or pinkish, 4-merous, small, numerous, in loose, branching panicles; fruit capsular, included in the calyx tube, glabrous.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham* 1116; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1591; vicinity of Bartica, Essequibo River, Lat.

6° 25' N., September 3-12, 1922, *De La Cruz 1890*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1981*.

Range: American tropics.

5. DESMOSCELIS Naudin

1. **Desmoscelis villosa** (Aublet) Naudin, *Annales des Sciences Naturelles*, III. 13: 30. 1849.

Melastoma villosum Aublet, *Histoire des Plantes de la Guiane Française* 1: 428. pl. 168. 1775.

A densely villous herb; leaves opposite, mostly 5-nerved, ovate-elliptic, minutely serrulate, 3-6 cm. long, 1.5-3 cm. broad; flowers small, purple, 5-merous, in axillary, branched, leafy panicles which are often very short; fruit capsular, included in the calyx tube, densely villous.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1590*.

Range: Brazil and the Guianas.

6. RHYNCHANTHERA DeCandolle

1. **Rhynchanthera dichotoma** (Desrousseaux) DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 107. 1828.

Melastoma dichotoma Desrousseaux, in Lamarck, *Encyclopédie Méthodique, Botanique* 4: 41. 1796.

A rather hirsute shrub 1-2 m. high; leaves opposite, ovate, cordate, 7-9-nerved, serrate, 4-9 cm. long, 2-4 cm. broad; flowers whitish, large, 1-2 cm. in diameter, 5-merous, in large, terminal or axillary leafy panicles; fruit capsular, included in the calyx tube, villous or hirsute.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1873*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2952*.

Range: Trinidad to southern Brazil.

7. ADELOBOTRYS DeCandolle

1. **Adelobotrys guianensis** (DeCandolle) Gleason, *Brittonia* 1: 141. 1932.

Davya guianensis DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 105. 1828.

Adelobotrys adscendens Triana, *Journal of Botany* 5: 210. 1867, in part; not *Melastoma adscendens* Swartz, 1798.

A nearly glabrous shrub climbing by rootlets; leaves opposite, broadly ovate to ovate-elliptic, shortly acuminate, 10-15 cm. long, 4-10 cm. broad, 5-nerved with a marginal pair; flowers white, tinged with pink, in terminal paniced umbels; fruit capsular, included in the calyx tube, appressed strigose.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2677.

Range: Northern South America.

8. LEANDRA Raddi

1. *Leandra divaricata* (Naudin) Cogniaux, in Martius, *Flora Brasiliensis* 14⁴: 196. 1886.

Clidemia divaricata Naudin, *Annales des Sciences Naturelles*, III. 17: 373. 1852.

Oxymeris secundiflora Triana, *Transactions of the Linnæan Society* 28: 95. 1871.

A low, pubescent shrub; leaves opposite, ovate-elliptic, tapering at both ends, acuminate, 5-10 cm. long, 2-5 cm. broad, minutely serrulate, 5-nerved; flowers whitish, small, in short, terminal, hairy panicles; fruit berry-like, included in the calyx tube, pubescent.

Graham 260 was about 6 dm. high, found near the river shore in dense jungle growth.

Vicinity of Kartabo, July 14, 1924, *Graham* 260; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1985.

Range: African tropics, Brazil and the Guianas.

9. TOCOCA Aublet

1. *Tococa aristata* Benthams, in Hooker, *Journal of Botany* 2: 305. 1840.

A shrub; leaves opposite, densely hirsute, ovate-elliptic, abruptly acuminate, 12-30 cm. long, 6-10 cm. broad, the margin serrate-ciliate, the petioles with conspicuous, bladder-like swellings or formicaria; flowers 5-6-merous, cream-colored, stamens exceeding the petals; fruit berry-like, included in the calyx, hirsute with mostly glandular hairs.

Hingston (1932) reports that the swollen petioles are occupied by ants of the genus *Pheidole*, sub-genus *Elasmopheidole*. With the ants live clusters of coccids as ant cattle together with reddish mites and

minute fish-insects which act as scavengers. On the lower surface of the leaf, near the petiole, the ants build a feeding shelter of insect fragments.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1622*; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1906*; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1916*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3015*.

Range: Throughout British Guiana; French Guiana to the upper Amazon valley.

10. MICONIA Ruiz and Pavon

- a. Fruits densely hairy, pubescent, or tomentose:
 - b. Leaves beneath, as well as the stem and fruit, densely red-brown, stellate-tomentose.....1. *M. rubiginosa*
 - bb. Leaves beneath, as well as the stem and fruit, not densely red-brown tomentose:
 - c. Plant bristly pubescent; anthers appendaged.....2. *M. ceramicarpa*
 - cc. Plant stellate-tomentose; anthers simple.....3. *M. dodecandra*
- aa. Fruits not densely hairy, pubescent or tomentose:
 - b. Fruit glabrous, or nearly so, sometimes roughened:
 - c. Leaves not ciliate on the margin.....4. *M. guianensis*
 - cc. Leaves ciliate on the margin:
 - d. Leaves smooth, veins rarely hairy above; calyx limb without an external ring.....5. *M. ciliata*
 - dd. Leaves slightly roughened, veins hairy above; calyx limb with a thick, spreading, more or less fleshy, continuous, external ring.
 - 6. *M. racemosa*
 - bb. Fruit not glabrous:
 - c. Leaves thin, papery, light green.....7. *M. acinodendrum*
 - cc. Leaves not thin, papery, or light green:
 - d. Leaf margin ciliate.....6. *M. racemosa*
 - dd. Leaf margin not ciliate:
 - e. Leaves narrowly elliptic to lance-ovate:
 - f. Leaves reddish-brown below.....8. *M. chrysophylla*
 - ff. Leaves gray to dark green below.....9. *M. myriantha*
 - ee. Leaves ovate to broadly ovate-elliptic:
 - f. Fruit less than 2 mm. in diameter; connective of anthers prolonged below the insertion of the filament.....10. *M. lepidota*
 - ff. Fruit 2 mm. or more in diameter; connective of anthers not prolonged below the insertion of the filament.....11. *M. parviflora*

1. **Miconia rubiginosa** (Bonpland) DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 183. 1828.

Melastoma rubiginosum Bonpland, *Monographie des Mélastomacées* pl. 47. 1816.

Tamonea rubiginosa Krassn. in Engler and Prantl, *Die Natürlichen Pflanzenfamilien* 3⁷: 142. 1893.

A brown-tomentose shrub or tree 2-7 m. high; leaves opposite, thick, 3-nerved, rough, elliptic, acuminate, shiny above, 8-15 cm. long, 3-6 cm. broad, entire; flowers small, white, in large, terminal, compound panicles; fruit berry-like, included in the calyx tube, brown stellate-pubescent.

The wood is hard and durable, and is used for fence posts.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1993.

Range: Porto Rico to Brazil and Colombia.

2. **Miconia ceramicarpa** (DeCandolle) Cogniaux, in Martius, *Flora Brasiliensis* 14⁴: 338. 1887.

Clidemia ceramicarpa DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 160. 1828.

Miconia spondylantha DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 184. 1828.

A pubescent shrub; leaves opposite, elliptic, acuminate, rough, 5-nerved, minutely crenate, 10-20 cm. long, 3-8 cm. broad; flowers white, in rather small, terminal panicles; fruit berry-like, included in the calyx tube, bristly pubescent.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1969; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2454; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2935.

Range: Brazil and the Guianas.

3. **Miconia dodecandra** (Desrousseaux) Cogniaux, in Martius, *Flora Brasiliensis* 14⁴: 243. 1887; in DeCandolle, *Monographiæ Phanerogamerum* 7: 740, 1190. 1891.

Melastoma dodecandra Desrousseaux, in Lamarck, *Encyclopédie Méthodique, Botanique* 4: 46. 1796.

Miconia fothergilla Naudin, *Annales des Sciences Naturelles, Botanique* III. 16: 119. 1851.

A tomentose shrub or tree; leaves opposite, elliptic, acuminate, smooth above, entire, 5-nerved, 10-20 cm. long, 4-10 cm. broad; flowers white, in rather dense, terminal, corymbiform panicles; fruit berry-like, included in the calyx tube, gray stellate-tomentose.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2426.

Range: Mexico and Cuba to southern Brazil.

4. **Miconia guianensis** (Aublet) Cogniaux, Jahrbuch des Königlichen Botanischen Gartens, Berlin 4: 280. 1886; in Martius, Flora Brasiliensis 4⁴: 245. 1887; in DeCandolle, Monographiae Phanerogamerum 7: 794. 1891.

Tamonea guyanensis Aublet, Histoire des Plantes de la Guiane Française 1: 441. 1775.

A somewhat tomentose tree; leaves opposite, elliptic, 10-20 cm. long, 4-8 cm. broad, smooth above, entire, 5-nerved; flowers white or yellow, in terminal, branched panicles; fruit berry-like, included in the calyx tube, glabrous, or soon becoming so.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1614; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2713; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2722.

Range: Cuba to southern Brazil.

5. **Miconia ciliata** (L. C. Richard) DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 3: 179. 1828.

Melastoma ciliatum L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 109. 1792.

A nearly glabrous shrub 3-6 m. high; leaves opposite, smooth, elliptic to elliptic-lanceolate, 5-nerved, acuminate, minutely dentate, ciliate on the margin, 10-25 cm. long, 3-8 cm. broad; flowers pink, in terminal panicles, sometimes one-sided; fruit berry-like, included in the calyx tube, glabrous or nearly so.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1909; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2012; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2951.

Range: Guianas.

6. **Miconia racemosa** (Aublet) DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 179. 1828.

Melastoma racemosum Aublet, *Histoire des Plantes de la Guiane Française* 1: 406. pl. 156. 1775.

A nearly glabrous tree; leaves opposite, ovate-elliptic, acuminate, slightly rough, 5-nerved, minutely serrate, ciliate on the margin, 10-20 cm. long, 4-10 cm. broad; flowers greenish-yellow, in terminal panicles; fruit berry-like, included in the calyx tube, glabrous or nearly so.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1968; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2627; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3055.

Range: West Indies to southern Brazil.

7. **Miconia acinodendrum** (Linnæus) Triana, *Transactions of the Linnæan Society* 28: 111. 1873.

Melastoma acinodendron Linnæus, *Species Plantarum* 389. 1753.

A pubescent shrub; leaves opposite, ovate, abruptly acuminate, cordate at the base, dentate-crenate, ciliate on the margin, 5-nerved, 10-15 cm. long, 6-8 cm. broad; flowers white, in conical, terminal panicles, the stamens conspicuously exerted; fruit berry-like, included in the calyx tube, minutely stellate-pubescent.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1567.

Range: West Indies and the Guianas.

8. **Miconia chrysophylla** (L. C. Richard) Urban, *Symbolæ Antillanæ* 4: 459. 1910.

Melastoma chrysophyllum L. C. Richard, *Actes de la Société d'Histoire Naturelles de Paris* 1: 109. 1792.

Miconia fulva DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 3: 180. 1828.

A shrub or tree; leaves opposite, narrowly elliptic to ovate-lanceolate, tapering at both ends, upper ones whorled, smooth above, reddish brown, stellate-lepidote beneath, giving the appearance of a pitted surface, 3-nerved with a slightly crenate margin, 6-15 cm. long, 1-3 cm. broad; flowers in terminal panicles, often of whorled branches; fruit berry-like, included in the calyx tube, stellate-lepidote.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2441.

Range: Porto Rico to Bolivia.

9. **Miconia myriantha** Benthām, in Hooker, Journal of Botany 2: 314. 1840.

Miconia minutiflora of various authors, especially Triana, Transactions of the Linnæan Society, Botany 28: 118. 1871.

A shrub or small tree; leaves opposite, entire, smooth, 3-nerved, 6-12 cm. long, 2-3 cm. broad, flowers white, small, in compound, terminal panicles; fruit berry-like, included in the calyx tube, stellate-pubescent.

For a full discussion of this species and its relation to closely allied species, see H. A. Gleason, "Miconia minutiflora and two allied species," Bulletin of the Torrey Botanical Club 55: 117. 1928.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1628.

Range: Trinidad and the Guianas.

10. **Miconia lepidota** DeCandolle, Prodrōmus Systematis Naturalis Regni Vegetabilis 3: 180. 1828.

A tree; leaves opposite, smooth, ovate-elliptic, acuminate, entire, 10-20 cm. long, 3-7 cm. broad; flowers in long, terminal, freely branched panicles; fruit berry-like, included in the calyx tube, closely stellate-tomentulose.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2452.

Range: Bolivia to Colombia and the Guianas.

11. **Miconia parviflora** (Benthām) Cogniaux, in Martius, Flora Brasiliensis 14⁴: 249. 1887.

Diplochita parviflora Benthām, in Hooker, Journal of Botany 2: 302. 1840.

A shrub or small tree; leaves opposite, large, ovate-elliptic to obovate, abruptly acuminate, smooth above, 5-nerved, entire abrupt at the base, 15-25 cm. long, 6-10 cm. broad; flowers in dense, terminal, freely branched panicles; fruit berry-like, included in the calyx, closely stellate-tomentulose.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2424.

Range: Trinidad and the Guianas.

11. CLIDEMIA D. Don

- a. Flowers in dense, sessile clusters in the axils of the leaves, 4-merous

1. *C. rubra*

- aa. Flowers paniculate, 5-6-merous:

- b. Flowers in few-flowered, short panicles, little longer than the petioles; sepals shorter than the calyx tube or obsolete; ovary free:

c. Leaves obtuse or tapering at the base; calyx densely hairy.

2. *C. dentata*

cc. Leaves cordate at the base; calyx with scattered hairs:

d. Petioles less than 1.5 cm. long.....3. *C. hirta*

dd. Petioles more than 1.5 cm. long.....4. *C. elegans*

bb. Flowers in many-flowered racemes, these usually more than half as long as the leaves; sepals longer than the calyx tube; ovary half or more inferior:

c. Inflorescence a spike-like panicle; fruit with thin, stellate-pubescent and long simple hairs.....5. *C. dependens*

cc. Inflorescence a much branched panicle; fruit with thin, stellate-pubescent and glandular hairs.....6. *C. rariflora*

1. **Clidemia rubra** (Aublet) Martius, Nova Genera et Species Plantarum quas in Itinere per Brasiliam Collegit 3: 152. pl. 281. 1832.

Melastoma rubrum Aublet, Histoire des Plantes de la Guiane Française 1: 416. 1775.

A very hirsute, woody herb or shrub; leaves opposite, ovate, acuminate, 6-15 cm. long, 3-6 cm. broad, serrulate, 5-nerved; flowers white, 4-merous, clustered in the axils of the leaves; fruit berry-like, black or purple included in the calyx tube, densely hirsute.

The fruits of this species are considered edible, although none of the Melastomaceæ have fruits of any particular economic value.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 233; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2470.

Range: Mexico to Bolivia.

2. **Clidemia dentata** D. Don, Memoirs of the Wernerian Natural History Society 4: 308. 1823.

Melastoma dentatum Pavon, in DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 3: 158. 1828.

Melastoma purpureum Pavon, in DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 3: 158. 1828.

A low, hirsute shrub; leaves opposite, ovate, acuminate, hairy, minutely serrulate, 5-15 cm. long, 3-9 cm. broad, 5-nerved; flowers white, in short, axillary panicles; fruit berry-like, included in the calyx tube, densely hairy.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1973; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3054.

Range: Trinidad and Mexico to northern South America.

3. **Clidemia hirta** (Linnæus) D. Don, Memoirs of the Wernerian Natural History Society 4: 309. 1823.

Melastoma hirta Linnæus, Species Plantarum 390. 1753.

Clidemia crenata DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 3: 157. 1828.

A low, hirsute shrub; leaves opposite, ovate-elliptic, acuminate, 3-5-nerved, crenate, 6-10 cm. long, 4-7 cm. broad, petioles less than 1.5 cm. long; flowers white, 5-6-merous, in short, axillary panicles; fruit berry-like, included in the calyx tube, hirsute with scattered hairs.

Vicinity of Kartabo, July 5, 1924, *Graham* 155; Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 219; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1970; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2908.

Range: Mexico and Cuba to Brazil.

4. **Clidemia elegans** (Aublet) D. Don, Memoirs of the Wernerian Natural History Society 4: 309. 1823.

Melastoma elegans Aublet, Histoire des Plantes de la Guiane Française 1: 427. 1775.

Clidemia hirta var. *elegans* Grisebach, Flora of the British West Indian Islands, 247. 1860.

A low, hirsute shrub; leaves opposite, broadly ovate to elliptic, doubly crenate, 5-10 cm. long, 4-8 cm. broad, 3-5-nerved, petioles more than 1.5 cm. long; flowers white, 5-6-merous, nearly 2 cm. broad, in short, axillary panicles; fruit berry-like, included in the calyx tube, hirsute with scattered hairs.

This species differs from the preceding largely in its cordate, conspicuously crenate leaves, and may best be considered a variety of *C. hirta*, as treated by Grisebach.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2922.

Range: Mexico and Cuba to Brazil.

5. **Clidemia dependens** D. Don, Memoirs of the Wernerian Natural History Society 4: 307. 1823.

A low, hairy shrub; leaves opposite, ovate to elliptic, acuminate, minutely crenate-serrulate, 3-5 nerved, 6-15 cm. long, 3-5 cm. broad; flowers 5-6-merous, in hairy, axillary and terminal, spike-like panicles;

fruit berry-like, included in the calyx tube, with thin, stellate-pubes-
cence and long, simple hairs.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3053.

Range: American tropics.

6. **Clidemia rariflora** Benthams, in Hooker, *Journal of Botany* 2: 308.
1840.

Staphidium pliostemon Naudin, *Annales des Sciences Naturelles*, III. 17: 313.
1852.

Clidemia pleiostemon Cogniaux, in DeCandolle, *Monographiæ Phanerogamerum*
7: 1000. 1891.

A low, hairy shrub; leaves opposite, ovate, acuminate, subcordate
at the base, 5-nerved, crenate, 6-15 cm. long, 3-6 cm. broad; flowers
small, in loose, axillary panicles; fruit berry-like, included in the
calyx tube, with stellate-pubescence and glandular hairs.

Between the Demerara and Berbice Rivers, Lat. 5° 50' N., July
July 15-19, 1922, *De La Cruz* 1652; Malali, Demerara River, Lat.
about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2608.

Range: Brazil and the Guianas.

12. BELLUCIA Necker

1. **Bellucia grossularioides** (Linnæus) Triana, *Transactions of the*
Linnæan Society 28: 141. 1871. MESOPRA

Melastoma grossularioides Linnæus, *Species Plantarum* 390. 1753.

Bellucia Aubletii Naudin, *Annales des Sciences Naturelles*, III. 16: 102. 1851.

A glabrous shrub or small tree; leaves opposite, broadly ovate-
elliptic, 15-25 cm. long, 10-15 cm. broad, tapering at both ends,
brown-tomentose below when young; flowers large, white or pink,
solitary or clustered on the naked branches; fruit broadly hemispheric,
berry-like, included in the calyx tube, glabrous.

The fruit is a large, fleshy, yellow berry, and is considered edible.
Graham 410 was taken from a robust shrub in the compound in front
of the Kartabo laboratory. Dr. Gleason assures the writer that he
has observed this species as a tall tree of the high forest at Tumatumari.

Vicinity of Kartabo, August 3, 1924, *Graham* 410; Malali, Demerara
River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2672.

Range: Tropical South America.

13 HENRIETTEA DeCandolle

1. **Henriettea multiflora** Naudin, Annales des Sciences Naturelles, III. 18: 105. 1852.

A nearly glabrous shrub or tree; leaves opposite, broadly ovate-elliptic, 10-30 cm. long, 5-15 cm. broad, shortly acuminate, finely stellate below, tapering at the base, 3-nerved; flowers white, in lateral clusters at leafless nodes; fruit leathery, fleshy, berry-like, included in the calyx tube, with stellate-lepidote pubescence and few scale-like hairs.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1899.

Range: Guianas and Trinidad.

96. ONAGRACEÆ: Evening-primrose Family

1. JUSSLÆA Linnæus

Stamens 3-6, 1-rowed.....1. *J. oocarpa*

Stamens 8-12, 2-rowed:

Leaves linear; mature fruit 2-4 cm. long.....2. *J. angustifolia*

Leaves ovate to ovate-lanceolate; mature fruit less than 2 cm. long:

Calyx-lobes broadly triangular-acuminate, 8-15 mm. long.....3. *J. nervosa*

Calyx-lobes ovate-acuminate, 3-7 mm. long:

Stems glabrous or appressed hairy; leaves broadly ovate-elliptic, nearly half as broad as long.....4. *J. linifolia*

Stems with spreading hairs; leaves narrowly ovate-elliptic to linear, several times as long as broad.....5. *J. leptocarpa*

1. **Jussiaea oocarpa** Wright, in Grisebach, Catalogus Plantarum Cubensium 108. 1866.

Oöcarpon jussiaoides Micheli, in Martius, Flora Brasiliensis 13²: 173. 1875.

A woody herb; leaves alternate, linear-lanceolate, 6-10 cm. long; flowers small, yellowish, solitary in the axils of the leaves; fruit capsular, the seeds conspicuous through the constricted wall when mature.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1907.

Range: American tropics.

2. **Jussiaea angustifolia** Lamarck, Encyclopédie Méthodique, Botanique 3: 331. 1789.

Jussieua suffruticosa of DeCandolle and subsequent authors, not of Linnæus 1753; for synonymy see Britton and Wilson (1923-26) 6¹: 46.

An herb 6-10 dm. high, often woody at the base, villous-pubescent or glabrous, leaves alternate, linear, 3-10 cm. long, 2-10 mm. broad;

flowers yellow, solitary in the leaf axils; petals obovate, wedge-shaped, sessile, half as long again or twice to three times as long as the calyx-lobes; fruit a capsule 2-4 cm. long, subcylindric, tapering at the base; seeds in several rows in each cavity.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham 134*.

Range: North Carolina and Arkansas to Florida and Texas, West Indies to Brazil.

3. *Jussiaea nervosa* Poiret, in Lamarck, *Encyclopédie Méthodique*, Suppl. 3: 199. 1813.

A shrub; leaves alternate, ovate-oblong, acute to mucronate at the apex, nerves prominent, 5-15 cm. long, 1.5-3 cm. broad; flowers large, showy, yellow, solitary in the leaf axils, petals exceeding the sepals; fruit a capsule, 4-angled, about 1.5 cm. long.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1908*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1946*; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2436*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2953*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3058*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3065*.

Range: Guianas.

4. *Jussiaea linifolia* Vahl, *Eclogæ Americanæ* 2: 32. 1798.

A shrubby herb; leaves alternate, ovate to ovate-elliptic, tapering at both ends, 3-8 cm. long, .5-2 cm. broad; flowers small, yellow, solitary in the leaf axils; petals equalling the calyx; fruit capsular, 1-2 cm. long.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1667*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1858*; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2704*.

Range: American and African tropics.

5. *Jussiaea leptocarpa* Nuttall, *Genera of North American Plants* 1: 279. 1818.

Jussiaea pilosa Humboldt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 6: 101. 1823.

A somewhat shrubby plant 3-20 dm. high; leaves alternate, lanceolate or elliptic, tapering to a subsessile base, 2-10 cm. long, 1 cm. broad;

flowers short-stalked, solitary in the leaf axils, petals obovate, as long as the calyx lobes; fruit a capsule, subcylindric, narrowed below, 2-3 cm. long; the seeds in one row in each cavity.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1948*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3004*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 3023*.

Range: Southeastern United States, West Indies, continental tropical America and tropical Africa.

97. ARALIACEÆ. Aralia Family

Nothopanax Guilfoylei (Cogniaux and Marché) Merrill, a shrub with 5-7 white-margined leaflets, is reported by Hitchcock (1921), to be used a great deal as a hedge plant along the coast.

98. UMBELLIFERÆ. Carrot Family

Although there are no specimens of Umbelliferae from British Guiana in the herbarium, Dr. Mildred E. Mathias has assured the writer that at least the two following widely distributed members of the family are known to occur in the northern coastal area.

Hydrocotyle umbellata Linnæus is a low trailing, glabrous herb with flowers long-pedicellate in simple umbels, the leaves orbicular, peltate, 1.5-5 cm. long. The fruit is about 2 mm. long, 2-3 mm. broad, notched at the base and apex. The plant occurs from eastern United States southward through Central America and the West Indies and through continental tropical America; it also occurs in tropical Africa.

Eryngium foetidum Linnæus, the Fitweed, is a diffuse, dichotomously branched, ill-smelling herb with oblong-spatulate basal leaves up to 20 cm. long, sheathing at the base, serrate with bristly teeth. The white flowers are in composite-like, cylindric, ovoid heads about 1 cm. long. The plant ranges throughout the West Indies and continental tropical America.

99. MYRSINACEÆ. Myrsine Family

Corolla in the bud imbricated, that is, lobes overlapping:

- Inflorescence a simple raceme.....1. *CYBIANTHUS*
 Inflorescence a compound raceme or panicle.....2. *WEIGELTIA*

Corolla in the bud convolute, that is, the lobes wholly wrapped in one another:

- Flowers 4-parted; leaves crenate to serrate.....3. *ARDISIA*
 Flowers 5-parted; leaves entire or nearly so.....4. *STYLOGYNE*

1. CYBIANTHUS Martius

1. **Cybianthus Brownii** Gleason, Bulletin of the Torrey Botanical Club
 53: 293. 1926.

A shrub; leaves alternate, oblong-elliptic to spatulate, smooth, acute or acuminate at the apex, cuneate at the base, entire; flowers in axillary, spike-like racemes; fruit a yellow berry 5-8 mm. in diameter.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1648.

Range: British Guiana.

2. WEIGELTIA A. DeCandolle

1. **Weigeltia surinamensis** (Sprengel filius) Mez, Das Pflanzenreich,
 9 (IV. 236): 289. 1902.

Salvadora surinamensis Sprengel filius, Tentamen Supplementi ad Systematis Vegetabilium n. 25. 1828.

Peckia surinamensis O. Kuntze, Revisio Generum Plantarum 2: 402. 1891.

A shrub; leaves alternate, entire, elliptic to spatulate, 10-20 cm. long, 3-5 cm. broad, acute at the apex; flowers small, white, in axillary or lateral, loose, compound panicles; fruit a 1-seeded drupe.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2418.

Range: Guianas.

3. ARDISIA Swartz

1. **Ardisia guianensis** (Aublet) Mez, in Urban, Symbolæ Antillanæ 2:
 392. 1901.

Icacorea guianensis Aublet, Histoire des Plantes de la Guiane Française 2, Suppl. 1: pl. 368. 1775.

Ardisia acuminata Willdenow, Species Plantarum 1: 1062. 1791.

A shrub; leaves alternate, ovate-elliptic, acuminate, crenate, 6-15 cm. long, 3-5 cm. broad; flowers pale red, in panicles, shorter than the leaves; fruit a drupe.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1996.

Range: West Indies and northern South America.

4. STYLOGYNE A. DeCandolle

1. **Stylogyne Schomburgkiana** (DeCandolle) Mez, Das Pflanzenreich 9 (IV. 236): 270. 1902.

Badula Schomburgkiana A. DeCandolle, Annales des Sciences Naturelles, II. 16: 90. 1841; Prodromus Systematis Naturalis Regni Vegetabilis 8: 110. 1844.

Ardisia Schomburgkiana Miquel, in Martius, Flora Brasiliensis 10: 289. 1856.

A shrub 1-3 m. high; leaves alternate, thick, oblong, ovate-elliptic, 10-25 cm. long, 5-8 cm. broad, shortly acuminate, cuneate at the base; flowers in a terminal, cymose panicle; fruit a drupe.

Matope, Cuyuni River, July 23, 1924, *Graham* 342.

Range: Guianas.

100. SAPOTACEÆ. Sapodilla Family

1. CHRYSOPHYLLUM Linnaeus

1. **Chrysophyllum Cainito** Linnaeus, Species Plantarum 192. 1753.

STAR APPLE

Chrysophyllum portoricense A. DeCandolle, in DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 8: 157. 1844.

A large or medium sized tree with dense crown; leaves short-petioled, ovate to oblong, abruptly acute or short acuminate at the apex, deep green and glabrous above, densely covered beneath with shiny, brown hairs; flowers small, pedicelled and clustered in the leaf axils; fruit a drupe-like berry, smooth, globose, yellow, green or purple.

The fruit has greenish, milky flesh, containing several large seeds; when cut transversely the seeds suggest the points of a star, hence the common name. The fruit is one of the important ones of tropical America, the pulp sweet, though insipid, and the tree is used as a shade tree, when it makes a handsome ornamental.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 2018.

Range: West Indies and tropical America.

Achras Sapota Linnaeus, the Sapodilla, a native of Central America and southern Mexico, is found in the colony. Its fruit is considered one of the best indigenous fruits of tropical America, being round-conical, 6-10 cm. long, with a skin thin, rusty, and sometimes scurfy, giving it

the appearance of an Irish potato. The flesh is yellow-brown, soft and delicious when ripe, although otherwise it contains much tannin and a milky latex which renders it unpalatable. The bark contains a milky latex, commercially known as chicle, obtained by tapping the trunk, which in the United States forms the basis of chewing gum.

Lucuma mammosa Gärtner, the Balata-balli, Barata-balli, or Barta-balli, resembles the Balata and its wood is used for building, interior finishing, and furniture. The fruit of this tree is the Mamey Sapote, globose or elliptical in shape, 8-18 cm. long, with soft, melting flesh of very sweet flavor. It is specially used in making marmalades.

Mimusops sp., especially **M. globosa** Gärtner, the Balata, Koberu, or Bullet Tree, reported by Zon and Sparhawk (1923), is particularly valuable for the gum it contains and is seldom cut, although the wood is very hard, durable, and excellent for posts, buildings, spokes, staves, and shingles. The trees have a high, spreading crown of dark foliage and are found along river banks, particularly in the eastern part of the colony.

Sideroxylon sp., known as Vogelkop, Fogelkop, or Kudibutshi, furnishes light-brown, close-grained, fairly hard wood for paddles, oars and interior work. It is reported by Zon and Sparhawk (1923) as a timber tree of the colony.

101. SYMPLOCACEÆ. Sweet-leaf Family

1. SYMPLOCOS Jacquin

1. **Symplocos guianensis** (Aublet) Gürke, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 4¹: 172. 1891.

Ciponima guianensis Aublet, Histoire des Plantes de la Guiane Française 1: 567. 1775.

A hirsute shrub; leaves alternate, ovate-oblong, 6-15 cm. long, 2-4 cm. broad, acuminate, the margin ciliate and with short, scattered teeth; flowers cream-colored in very short, axillary racemes; fruit a small drupe.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2927.

Range: American tropics.

102. LOGANIACEÆ. Logania Family

1. STRYCHNOS Linnæus

1. **Strychnos Melinoniana** Baillon, Bulletin Société Linnéenne de Paris

1: 256. 1880.

WHITE DEVIL-DOER

A climbing shrub; leaves opposite, ovate-elliptic, short petioled, 6-20 cm. long, 3-10 cm. broad, shiny, prominently 3-nerved; inflorescence 1-4 cm. long, dense, axillary, the flowers white, sweet-scented; fruit berry-like.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November, 5, 1922, *De La Cruz* 2731.

Range: Guianas.

Strychnos guianensis Martius has been reported by Cheney (1931) as occurring in the region. The latex of the stem and bark is used as an arrow poison. Eighteen species of this genus, native to northern South America, are so used, and are known as Curare.

Spigelia fruticulosa Lamarck is also reported by Cheney (1932), is similarly used and occurs in the region.

103. GENTIANACEÆ. Gentian Family

Terrestrial or marsh plants:

Plants lacking chlorophyll; leaves reduced to scales.....1. *LEIPHAIMOS*

Plants green; leaves not reduced to scales:

Stigma capitate.....2. *LISIANTHUS*

Stigma bilamellate:

Flowers in dense elongate spikes; corolla white.....3. *COUTOUBEA*

Flowers not spicate; corolla pink or green.....4. *CHELONANTHUS*

Aquatic plants, with floating leaves.....5. *NYMPHOIDES*

1. LEIPHAIMOS Chamisso and Schlechtendal

1. **Leiphaimos corymbosa** (Splitgerber) Gilg, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 4²: 104. 1895.

Voyria corymbosa Splitgerber, Tijdschr. Nat. Geschied. 7: 136. pl. 2, f. 4. 1840.

Voyria nivea Miquel, Linnæa 19: 140. 1847.

Leiphaimos nivea Gilg, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 4²: 104. 1895.

A very slender, weak, saprophytic herb, with white stems 10-20 cm. high, bearing a few scale-like leaves; flowers 5-lobed, the lobes linear, spreading-reflexed, 10-15 mm. long, borne in a terminal, cymose inflorescence; fruit an oblong or linear capsule.

Graham 242 was found growing on the forest floor.

Vicinity of Kartabo, July 13, 1924, *Graham 242*.

Range: Guianas.

2. LISIANTHUS Linnaeus

1. **Lisianthus uliginosis** var. **guianensis** Grisebach, *Genera et Species Gentianarum* 182. 1839.

Chelonanthus uliginosis Gilg, in Engler and Prantl, *Die Natürlichen Pflanzenfamilien* 4²: 98. 1895.

An annual herb with stem tetragonal below, 1-2 m. high; leaves opposite, elliptic to ovate-lanceolate, tapering at both ends; flowers blue or white, 5 cm. long, in loose, terminal corymbs; fruit an ovoid capsule, 2-3 times as long as the calyx, with persistent style 2-3 times the length of the capsule.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1620*.

Range: Northern South America.

3. COUTOUBEA Aublet

Flowers 12-20 mm. long, mostly sessile, in leafless spikes. 1. *C. spicata*
Flowers less than 12 mm. long, mostly pedicellate, in leafy spikes. 2. *C. ramosa*

1. **Coutoubea spicata** Aublet, *Histoire des Plantes de la Guiane Française* 1: 72. 1775.

A large, glabrous herb with simple or branched stem; leaves opposite, sessile, oblong to lanceolate-linear; flowers white, in long terminal spikes, or axillary in the uppermost leaves; fruit a 2-celled capsule.

Graham 216 was about 1 m. high and found growing on the sandy beach of the river.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 216*.

Range: American tropics.

2. **Coutoubea ramosa** Aublet, *Histoire des Plantes de la Guiane Française* 1: 74. 1775.

A glabrous herb less than 1 m. high; leaves opposite, linear to lanceolate-ovate, sessile; flowers white to purple in terminal and axillary, loose, leafy spikes; fruit a 2-celled capsule.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2466*.

Range: American tropics.

4. CHELONANTHUS Gilg

1. **Chelonanthus chelonoides** (Linnæus filius) Gilg, in Engler and Prantl, *Die Natürlichen Pflanzenfamilien* 4²: 98. 1895.

Lisianthus chelonoides Linnæus filius, *Supplementum Plantarum* 134. 1781.

A coarse, glabrous herb; leaves opposite, thin, broadly ovate, sessile; flowers large, 2-3 cm. long, in cymose racemes; fruit a 2-celled capsule.

Graham 130 was collected along a trail where it was of rather common occurrence.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 130; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1982.

Range: Northern South America.

5. NYMPHOIDES Hill

1. **Nymphoides Humboldtianum** (Humboldt, Bonpland, and Kunth) Kuntze, *Revisio Generum Plantarum* 429. 1891.

WATER SNOWFLAKE, FLOATING HEART

Villarsia Humboldtiana Humboldt, Bonpland and Kunth, *Nova Genera et Species Plantarum* 3: 187. 1818.

Limnanthemum Humboldtianum Grisebach, *Genera et Species Gentianarum* 347. 1839.

A glabrous perennial, aquatic herb; leaves solitary, long-petioled, 4-20 cm. broad, reniform; flowers white, long-pedicelled, borne in a sessile umbel at the base of the petiole; fruit a capsule, somewhat shorter than the calyx; seeds numerous, smooth, globose.

The genus *Nymphoides* is sometimes put in the Menyanthaceæ, the bog-bean family, which differs from the Gentianaceæ in habit, alternate or basal leaves, and in the corolla-lobes being induplicate-valvate in the bud instead of imbricate or not meeting.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1944.

Range: Mexico and Jamaica to southern Brazil.

104. APOCYNACEÆ. Dogbane Family

Leaves verticillate or uppermost opposite; shrubs, usually climbing.

1. ALLAMANDA

Leaves opposite:

Anther cells not appendaged at the base; plants erect.

2. TABERNÆMONTANA

Anther cells appendaged at the base and sometimes at the apex; plants scandent or erect:

Tips of the anthers exerted from the corolla; plants erect...3. *MALOUETIA*

Tips of the anthers not exerted; plants scandent.....4. *MANDEVILLA*

1. ALLAMANDA Linnæus

1. *Allamanda cathartica* Linnæus, Mantissa Plantarum 2: 214. 1771.

ALLAMANDA

Echites verticillata Sessé and Mocino, Flora Mexicana ed. 2, 39. 1894.

A large, woody vine or shrub, leaves in whorls of 3 or 4, the upper ones opposite, oblong, obovate, 10-18 cm. long, 3-5 cm. broad; flowers bright yellow, trumpet-shaped, 4-7 cm. broad, 7-9 cm. in length, in terminal clusters; fruit a suborbicular, densely prickly capsule 4-6 cm. broad.

This plant is a conspicuous element along the edges of the rivers where it often hangs in curtains from the trees of the jungle. It is sometimes grown as an ornamental.

Vicinity of Kartabo, August 15, 1924, *Graham 94*.

Range: Widely distributed in the West Indies and tropical America, and introduced into the African tropics.

2. TABERNÆMONTANA Linnæus

Flowers large, corolla 3-6 cm. broad.....1. *T. coronaria*

Flowers small, corolla 2-3 cm. broad:

Fruit smooth:

Calyx-lobes broadly ovate; leaves 10-17 cm. long.....2. *T. undulata*

Calyx-lobes narrowly ovate; leaves 5-8 cm. long.....3. *T. rupicola*

Fruit echinate.....4. *T. heterophylla*

1. *Tabernæmontana coronaria* (Jacquin) Willdenow, Enumeratio

Plantarum Horti Regni Botanici Berolinensis 1: 275. 1809.

Nerium coronarium Jacquin, Collectanea ad Botanicum 1: 138. 1786.

A shrub; leaves opposite, glabrous, long acuminate, oblong to elliptic, cuneate at the base, 6-10 cm. long, 2-3 cm. broad; flowers white with a yellowish tube, sweet-scented, 5 cm. broad, in terminal cymes; fruit a follicle, cylindric, with swollen portions at intervals.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz 1671*.

Range: Probably native to the East Indies, now introduced throughout the tropics.

2. **Tabernæmontana undulata** Vahl, *Eclogæ Americanæ* 2: 20. 1798.

PINWHEEL FLOWER

A shrub or small tree; leaves opposite, glabrous, elliptic-oblong to lanceolate, acuminate, 10-15 cm. long, 3-6 cm. broad; flowers white to cream-colored, in axillary, cymose clusters; fruit a follicle, reflexed, incurved at both ends, oblong-triquetrous.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1937; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2912.

Range: West Indies and the Guianas.

3. **Tabernæmontana rupicola** Benthām, in Hooker, *Journal of Botany* 3: 243. 1841.

A tree; leaves opposite, leathery, ovate-elliptic, tapering at both ends, 5-10 cm. long, 2-4 cm. broad; flowers white, the corolla tube 1 cm. long, the lobes equalling the tube; fruit a follicle, obovoid, obtuse-slender, incurved, smooth, 2.5 cm. long.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1660; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2637.

Range: Guianas.

4. **Tabernæmontana heterophylla** Vahl, *Eclogæ Americanæ* 2: 22. 1798.

A shrub 2-3 m. tall, glabrous; leaves opposite, ovate-elliptic, abruptly acuminate, 6-10 cm. long, 2-3 cm. broad; flowers white, scentless, the corolla 1.5 cm. long, the tube 11 mm. long; fruit a follicle, oblong-ovoid, muricate-echinate.

Graham 413 was nearly 2 m. high, the ripened fruit red, the immature green, then orange.

Vicinity of Kartabo, August 3, 1924, *Graham* 413.

Range: Guianas.

Tabernæmontana speciosa Poir, a native of the Guianas, has a bark reported by Cheney (1931) to be used as an arrow poison.

3. MALOUETIA A. DeCandolle

1. **Malouetia Schomburgkii** Mueller-Argoviensis, *Linnaea* 30: 409. 1859-60.

A glabrous shrub; leaves opposite, acuminate, oblong to elliptic, leathery, 5-15 cm. long, 2-5 cm. broad; flowers long-peduncled, in

cymose umbels, the corolla lobes equalling the tube; fruit a follicle, slender, curved, up to 35 cm. in length.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1874.

Range: Guianas.

4. MANDEVILLA Lindley

Plant tomentose throughout, including the flower and seed. 1. *M. tomentosa*
 Plant glabrous, or with slight pubescence on the leaves beneath. 2. *M. scabra*

1. *Mandevilla tomentosa* (Vahl) O. Kuntze, Revisio Generum Plantarum 2: 416. 1891.

Echites tomentosa Vahl, Symbolæ Botanicæ 3: 44. 1794.

A tomentose vine; leaves opposite, oblong to elliptic, 8-15 cm. long, 4-8 cm. broad, cordate at the base, acuminate to mucronate at the apex; corolla silky, 6-7 cm. long, pale yellow outside with a blood-red throat; fruit a long, slender pod, densely tomentose and constricted between the seeds.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1990.

Range: Guianas.

2. *Mandevilla scabra* (Hoffmannsegg) K. Schumann, in Engler and Prantl, Die Natürlichen Pflanzenfamilien 4²: 171. 1895.

Echites scabra Hoffmannsegg, in Rømer and Schultes, Systema Vegetabilium 4: 795. 1819.

A slender, trailing shrub; leaves opposite, elliptic, acuminate at the apex, cordate at the base, 5-8 cm. long, 1-3 cm. broad; flowers yellow with a red throat, 7-9 cm. long, 6-7 cm. broad; fruit a follicle, relatively long (15-25 cm.) and slender, continuous or slightly articulated, glabrous.

Graham 289 was a prostrate, trailing plant found in an open clearing.

Vicinity of Kartabo, July 18, 1924, *Graham* 289.

Range: Brazil and the Guianas.

Aspidosperma excelsum Benthams, the Paddlewood or Yaruru, is reported by Beebe (1925) in the vicinity of Kartabo. It is a large tree used for making dugout canoe paddles by the natives.

Odontadenia speciosa Benthams, is reported by British Empire Exhibition (1924) along the rivers. It is a large woody vine with short-petioled, oblong to elliptic, glabrous leaves, 15-30 cm. long. Its large cymes of apricot colored blossoms are conspicuous.

Plumeria alba Linnæus, the Frangipani, is reported by Hitchcock (1921) as an ornamental in Georgetown. It is a tree with compact clusters of large, white flowers and stubby twigs which give it a coarse appearance when the elliptic to linear-lanceolate leaves have fallen.

105. ASCLEPIADACEÆ. Milkweed Family

Plants erect, herbaceous; flowers red and orange. 1. *ASCLEPIAS*

Plants scandent, herbaceous or woody; flowers variously colored but not red or orange:

Pedicels 1-2 mm. long; inflorescence widely branching. 2. *TASSADIA*

Pedicels 1-2 cm. long; inflorescence not widely branching. 3. *MATELEA*

1. *ASCLEPIAS* Linnæus

1. *Asclepias curassavica* Linnæus, Species Plantarum 215. 1753.

RED MILKWEED

Asclepias nivea var. *curassavica* O. Kuntze, Revisio Generum Plantarum 1: 418. 1891.

An erect, perennial herb with milky sap, glabrous or nearly so; leaves opposite, oblong-lanceolate, about 12 cm. long; flowers orange or yellow to red and purple, arranged in umbels; fruit a smooth, oblong-lanceolate follicle.

Various uses are made of this plant throughout its range. It is used in the treatment of cutaneous and venereal diseases and fevers. The pulverized leaves, fresh or dried, are applied to sores, and the latex is put into teeth to stop toothache, while in Honduras, according to Standley (1928), the milky latex is employed as a remedy for intestinal worms.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham* 108.

Range: One of the most common weeds of tropical America, and now rather universally distributed throughout the tropics.

2. *TASSADIA* Decaisne

1. *Tassadia propinqua* Decaisne, in DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis 8: 579. 1844.

A slender vine; leaves opposite, thick, lanceolate-elliptic, tapering to a point at the apex, 4-7 cm. long, 1-2 cm. broad; flowers small, about 3 mm. broad, arranged in much-branched cymes; fruit a follicle, thin, smooth.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1945; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2957.

Range: Guianas.

3. MATELEA Aublet

1. **Matelea palustris** Aublet, *Histoire des Plantes de la Guiane Françoise* 1: 278. 1775.

A woody vine; leaves opposite, ovate-elliptic, acuminate, slender-petioled, 10-15 cm. long, 3-5 cm. broad; flowers small, less than 1 cm. broad, in slender cymes; fruit a spindle-shaped follicle.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2698.

Range: Guianas.

106. CONVULVACEÆ. Morning-glory Family

Inflorescence terminal; fruit indehiscent.....1. *MARIPA*

Inflorescence axillary; fruit dehiscent by valves or a lid, dry:

Stigmas linear or oblong:

Plant densely tomentose; outer sepals similar to the inner ones; leaves acute to cordate at the base.....2. *JACQUEMONTIA*

Plant glabrate or sparsely pubescent; outer sepals unlike the inner ones; leaves cuneate at the base.....3. *ANISEIA*

Stigmas globose:

Stamens and style exserted; corolla usually salverform.....4. *QUAMOCLIT*

Stamens and style included; corolla funnelform or campanulate:

Stigma capitate or 2-3 globose; sepals glabrous or nearly so...5. *IPOMÆA*

Stigmas 2, linear-filiform to subulate or ovate; sepals with a dense, glossy-brown pubescence.....6. *THYELLA*

1. MARIPA Aublet

Corolla 1.5-2.5 cm. long; leaves oblong-ovate.....1. *M. cordifolia*

Corolla 3-4 cm. long; leaves ovate to rotund.....2. *M. scandens*

1. **Maripa cordifolia** Klotzsch, from Meissner, in Martius, *Flora Brasiliensis* 7: 210. 1869.

A sturdy vine; leaves alternate, thick, oblong-lanceolate, 10-20 cm. long, 5-10 cm. broad, slightly acuminate-attenuate at the apex; flowers numerous in leafy, pubescent, axillary or terminal panicles which often exceed the leaves in length; fruit berry-like, hard, indehiscent, 1-seeded.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2635.

Range: Guianas.

2. **Maripa scandens** Aublet, Histoire des Plantes de la Guiane Française 1: 230. pl. 91. 1775.

Maripa erecta Meyer, Primitiæ Floræ Essequiboensis 115. 1818.

Maripa cayennensis Meissner, in Martius, Flora Brasiliensis 7: 208. 1869.

A robust vine, climbing high; leaves alternate, thick, ovate to oblong, 5-20 cm. long, 4-10 cm. broad; flowers purple, 4-5 cm. long, corolla densely hairy, arranged in large, terminal racemes; fruit berry-like, hard, indehiscent, ovate-conical, 1-seeded.

Vicinity of Kartabo, June 28, 1924, *Graham* 123.

Range: Guianas and the Amazon valley.

2. JACQUEMONTIA Choisy

1. **Jacquemontia guyanensis** (Aublet) Meissner, in Martius, Flora Brasiliensis 7: 301. 1869.

Convolvulus guianensis Aublet, Histoire des Plantes de la Guiane Française 1: 136. 1775.

A rough, tomentose vine; leaves alternate, ovate, mucronate, 6-8 cm. long, 2-3 cm. broad; flowers white, in an axillary, long-peduncled head, the peduncle exceeding the leaves in length; fruit a 2-celled capsule.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1602.

Range: American tropics.

3. ANISEIA Choisy

1. **Aniseia martinicensis** (Jacquin) Choisy, Convolvulaceæ Orientales 144. 1838.

Convolvulus martinicensis Jacquin, Selectarium Stirpium Americanarum Historia 26. 1788.

Ipomœa martinicensis G. F. W. Meyer, Primitiæ Floræ Essequiboensis 98. 1818.

A slender, herbaceous vine, pubescent or glabrate; leaves alternate, obtuse, oblong-elliptic; flowers white, long-peduncled, axillary; fruit a 2-celled capsule.

The stems of this species are often used for lines in stringing fish, etc.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2444.

Range: Throughout the tropics.

4. QUAMOCLIT Moench

1. **Quamoclit vulgaris** Choisy, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 9: 336. 1845.

Ipomæa Quamoclit Linnæus, *Species Plantarum* 159. 1753.

Quamoclit Quamoclit Britton, *An Illustrated Flora of the Northern United States, Canada and the British Possessions*, ed. 1, 3: 22. 1898.

An annual, glabrous vine; leaves alternate, ovate, pinnately divided into many linear segments; peduncles 1-6 flowered, axillary, the corolla 2.5-4 cm. long, scarlet or rarely white; fruit a capsule, ovoid, 4-valved, about 1 cm. long, twice as long as the sepals.

Pomeroon District, Tabla, September 28, 1921, *De La Cruz* 1238.

Range: In the United States from Virginia to Florida, Kansas and Texas, escaped from gardens farther north; West Indies, tropical America and the old world tropics.

5. IPOMÆA Linnæus

Leaves compound.....1. *I. glabra*
Leaves simple:

Leaves ovate-reniform, acute at the apex, entire, the blades 5-8 cm. long.

2. *I. tiliacea*

Leaves ovate, acuminate at the apex, entire or variously lobed, the blades 5-15 cm. long.....3. *I. Batatas*

1. **Ipomœa glabra** (Aublet) Choisy, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 9: 362. 1845.

Convolvulus glaber Aublet, *Histoire des Plantes de la Guiane Française* 1: 138. 1775.

A glabrate, woody vine; leaves alternate, long-petioled, palmately divided; leaflets 3-5, 4-6 cm. long, 1-2 cm. broad, lanceolate-linear; flowers yellow, 4-5 cm. broad, on few-flowered, axillary peduncles; fruit capsular.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 391.

Range: American tropics.

2. **Ipomœa tiliacea** (Willdenow) Choisy, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 9: 375. 1845.

Convolvulus tiliaceus Willdenow, *Enumeratio Plantarum quas in Insulis Caribæis* 1: 203. 1809.

Ipomœa fastigiata Sweet, *Hortus Britannicus* ed. 1, 288. 1826.

Ipomœa gracilis House, *Annals of the New York Academy of Sciences* 18: 248. 1908; not *I. gracilis* R. Brown, 1810.

A large, herbaceous vine, glabrous or nearly so; leaves alternate, long-petioled, reniform, cordate, acuminate to acute, entire, blades 5-8 cm. long; peduncles few-several-flowered, about as long as the petioles, the pedicels short; corolla purple to pink, rarely white, 5-6 cm. long; fruit a capsule, 2-celled, subglobose, 8-10 mm. in diameter, the seeds glabrous.

This species is supposed to have yielded the following, *I. Batatas*, the Sweet Potato, through aboriginal selection and cultivation.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1957.

Range: Florida, West Indies and continental tropical America.

3. ***Ipomœa Batatas*** (Linnæus) Lamarck, Encyclopédie Méthodique, Botanique 6: 14. 1804. BATATA, SWEET POTATO

Convolvulus Batatas Linnæus, Species Plantarum 154. 1753.

Batatus edulis Choisy, Mémoires de la Société de Physique et d'Histoire Naturelle de Genève 6: 435. 1845.

A glabrous, rather delicate vine; leaves alternate, long-petioled, variously shaped, ovate to angular and lobed, cordate at the base, acuminate at the apex, blade 5-15 cm. long; peduncles about equalling the petioles; few-flowered; corolla 3-6 cm. broad, yellowish-purple to pink or white; fruit a capsule, 2-celled; seeds glabrous.

The rootstocks are large and fleshy, the well-known Sweet Potato. The plant is persistent or spontaneous after cultivation. In temperate as well as tropical countries, it is cultivated for its edible roots, which form the most important root-crop of the tropics.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2915; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2925.

Range: Now widely cultivated in temperate and tropical regions, its original home unknown. It is not now found anywhere in the wild state.

One would expect to see the Moon Flower or Moon Vine, ***Ipomœa bona-nox*** Linnæus, with its cordate, attenuate leaves and large, white, funnellform flowers, along the coast also, for it has spread from its home in Florida and the West Indies throughout the tropics. It is sometimes listed as *Calonyction aculeatus* (Linnæus) House.

Ipomœa pes-capræ (Linnæus) Roth, the Creeping Morning Glory, native of Florida and the West Indies but now widely distributed throughout the tropics, is reported by Hitchcock (1921) to be abundant

on the sand flats along the coast. It has suborbicular leaves, usually notched at the apex, rounded or cordate at the base, and a purple corolla 4-5 cm. long by 5-8 cm. broad.

6. *THYELLA* Rafinesque

1. *Thyella tamnifolia* (Linnæus) Rafinesque, *Flora Telluriana* 4: 84. 1836.

Ipomæa tamnifolia Linnæus, *Species Plantarum* 162. 1753.

Jacquemontia tamnifolia Grisebach, *Flora of the British West Indian Islands* 474. 1861.

A pilose vine; leaves alternate, cordate, ovate-acuminate, acute at the apex, cordate at the base, 3-12 cm. long, 6-8 cm. broad, the lower long-, the upper short-petioled; flowers in many-flowered, leafy-bracted, densely pilose, axillary heads; corolla blue, about 1 cm. in diameter; fruit a capsule much shorter than the sepals.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1888; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2916.

Range: West Indies and tropical America, also in the African tropics.

Cuscuta sp., Dodder or Love Vine, a yellow, leafless, parasitic climber, is reported by Hitchcock (1921) along the coast parasitic on the Sea Purslane, *Sesuvium portulacastrum*.

107. BORAGINACEÆ. Borage Family

1. *VARRONIA* P. Browne

Leaves broadly ovate; spikes axillary.....1. *V. guianensis*
Leaves ovate-elliptic; spikes terminal.....2. *V. cylindristachya*

1. *Varronia guianensis* Desvaux, *Journal de Botanique* 1: 270. 1808.

Cordia guianensis Roemer and Schultes, *Systema Vegetabilium* 4: 460. 1819.

A pubescent, woody shrub; leaves alternate, ovate, 6-12 cm. long, 3-5 cm. broad, crenate-dentate, acute at the apex, brown-tomentose below; flowers white or yellow, sessile, in compound, spike-like racemes in the axils of the upper leaves; fruit a drupe.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 133; Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 215; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922,

De La Cruz 1594; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2678.

Range: Guianas.

2. **Varronia cylindristachya** Ruiz and Pavon, *Floræ Peruvianæ et Chilenses Illustrantium Liber Primus* 2: 23. 1799.

Cordia cylindristachya Rømer and Schultes, *Systema Vegetabilium* 4: 459. 1819.

Lithocardium cylindrostachyum O. Kuntze, *Revisio Generum Plantarum* 2: 438, 977. 1891.

A pubescent, woody shrub; leaves alternate, thin, ovate-elliptic to lanceolate, 10-15 cm. long, 2.5-4 cm. broad, dentate; flowers small, greenish-white, in terminal spike-like racemes; fruit a small, red drupe.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3041.

Range: American tropics.

Cordia Aubletii DeCandolle, the Black Sage, a native of Guiana, is reported along drier portions of roads in the region by British Empire Exhibition (1924). It is a tree or shrub with alternate, broad leaves and small, funnelform flowers.

Cordia nodosa Lamarck, a shrub or tree with large, ovate leaves, is reported from the Kartabo region by Hingston (1932), who states that the swollen stems are inhabited by ants of the genus *Myrmelachista*, subgenus *Decamera*, and the coccids upon whose excretions the ants feed.

Heliotropium curassavicum Linnæus, the Seaside Heliotrope, cosmopolitan throughout the tropics, is reported by Hitchcock (1921) on the sand flats along the coast. It is a fleshy annual with entire, linear leaves and funnelform, blue or white flowers about 4 mm. broad.

108. VERBENACEÆ. Vervain Family

Leaves digitately compound; trees.....1. *VITEX*
Leaves simple; vines, shrubs or herbs:

Leaves entire.....2. *PETRÆA*

Leaves toothed:

Stamens 2; flowers appressed to the rachis.....3. *STACHYTARPHETA*

Stamens 4; flowers not appressed:

Fruit a juicy drupe; shrubs.....4. *LANTANA*

Fruit dry; shrubs or herbs.....5. *LIPPIA*

1. VITEX Linnæus

1. *Vitex Brittoniana* Moldenke, *Torreya* 33: 67. 1933.

A tree; leaves opposite, palmately 3-5 foliolate; leaflets glabrous, 10-20 cm. long, 5-7 cm. broad, elliptic-oblong, entire, acuminate; flowers blue and white, with puberulous corolla, in peduncled, axillary racemes; fruit a small drupe, the stone 4-celled.

Along Cuyuni River, near Camaria, July 23, 1924, *Graham* 323.

Range: West Indies and Guianas.

2. PETRÆA Linnæus

1. *Petræa Schomburgkiana* Schauer, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 11: 619. 1847.

PURPLE WREATH

A coarse, woody vine; leaves opposite, thick, scabrous, petioled, ovate, acuminate at the apex, with prominent veins; flowers pale blue, 4 cm. broad, in long, terminal racemes, calyx lobes conspicuously veined like the leaves; fruit dry.

The rough stems are sometimes employed as a substitute for rope.

Vicinity of Kartabo, July 14, 1924, *Graham* 254.

Range: Guianas.

Petræa volubilis Jacquin, also known as Purple Wreath, is listed by Hitchcock (1921) as a very common vine in Georgetown. The leaves are oblong to obovate, nearly sessile, rough, and the blue flowers are in long, pendent racemes. A white variety also occurs.

3. STACHYTARPHETA Vahl

1. *Stachytarpheta cajanensis* (L. Richard) Vahl, *Enumeratio Plantarum* 1: 208. 1804.

Verbena cayennensis L. Richard, *Actes de la Société d'Histoire Naturelle de Paris* 1: 105. 1792.

Valerianodes cayennense O. Kuntze, *Revisio Generum Plantarum* 2: 510. 1891.

A stout, much branched shrub 1-2.5 m. high; leaves opposite, ovate or elliptic, 3-8 cm. long, 2-4 cm. broad, crenate-serrate, rounded at the apex, abruptly tapering into the petiole; flowers white or pale blue, in slender spikes up to 30 cm. in length, 2 mm. thick, the furrows in which the fruits are embedded about as broad as the rachis; fruit included in the calyx, separating into 2 1-seeded nutlets.

Graham 107 was a scraggly shrub 1.2 m. high found in second growth jungle.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 107*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1857*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2926*.

Range: A rather frequent weed in tropical America, and occasionally planted for ornament.

4. LANTANA Linnæus

1. *Lantana camara* Linnæus, Species Plantarum 627. 1753.

LANTANA, RED OR YELLOW SAGE

A pubescent shrub up to 2 m. in height; leaves opposite, or verticillate, ovate to oblong-ovate, acute or obtuse at the apex, the base wedge-shaped, petioled; flowers in dense, stalked heads, yellow or orange, changing to red or purple; fruit a small, black drupe.

The fruit is juicy, sweet, and edible, though not very palatable. The leaves are used in making a decoction supposedly good for colds, stomach affections and other ailments. The plant is sometimes cultivated in the United States for its ornamental flowers. The white butterflies, *Pieris monuste* Linnæus, which were frequently seen flying across the river toward the southeast at Kartabo, were also observed by the writer to stop on the nearby islands and feed on the flowers of this species.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 214*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1889*; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2469*.

Range: American tropics and introduced into the old world tropics.

5. LIPPIA Linnæus

1. *Lippia micromera* Schauer, in DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 11: 587. 1847.

A delicate, woody shrub; leaves opposite or verticillate, small, hirsute, obovate-spatulate, coarsely crenate, 1-1.5 cm. long, 4-6 mm. broad; flowers white to purple, small, in short, peduncled, axillary heads; fruit dry, at length separating into 2 nutlets.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1923*.

Range: West Indies and northern South America.

Avicennia nitida Jacquin, the Black Mangrove or Courida, widely distributed in the tropics, occurs in the coastal lagoons and swamps according to Hitchcock (1921) and others. It may occur up the rivers as well. It is a tree up to 16 m. high with oblong-lanceolate leaves 3-8 cm. long and shallowly fissured, dark, scaly bark, which is orange-red within. The corolla is 4-lobed, bell-shaped, 10-14 mm. broad, the fruit a capsule 2-5 cm. long.

109. LABIATÆ. Mint Family

1. HYPTIS Jacquin

Leaves 4-8 cm. long; peduncles 2-8 cm. long.....1. *H. Parkeri*
 Leaves 1-5 cm. long; peduncles 2-10 mm. long.....2. *H. atrorubens*

1. **Hyptis Parkeri** Bentham, Labiatarum Genera et Species 108. 1833.

Mesospharium Parkeri O. Kuntze, Revisio Generum Plantarum 2: 525. 1891.

A slightly pubescent herb; leaves opposite, sessile, coarsely crenate-dentate, 4-8 cm. long, 1-2 cm. broad; flowers whitish, in long-peduncled, axillary heads; fruit of four 2-seeded nutlets.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1914.

Range: South America.

2. **Hyptis atrorubens** Poiteau, Annales du Muséum d'Histoire Naturelle, Paris 7: 466. 1806.

Mesospharium atrorubens O. Kuntze, Revisio Generum Plantarum 2: 525. 1891.

A slightly pubescent herb, creeping or ascending; leaves opposite, 1-5 cm. long, 1-2 cm. broad, crenate, ovate to oblong-lanceolate, obtuse or acute at the apex, more or less decurrent on the slender petiole; flowers white, in short-peduncled, axillary heads 1 cm. in diameter; fruit of four 1-seeded nutlets; fruiting calyx tubular, ribbed, 4-5 mm. long.

Along Camaria road, Cuyuni River, July 30, 1924, *Graham* 378; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1666.

Range: American tropics and introduced into the African tropics.

110. SOLANACEÆ. Potato Family

Corolla tubular or funnelform; embryo of the seed straight or little curved.

1. CESTRUM

Corolla rotate or broadly campanulate; embryo much curved.2. SOLANUM

I. CESTRUM Linnæus

1. **Cestrum latifolium** Lamarck, Illustrationes des Genres 2: 5. 1791.

A large shrub; leaves alternate, thin, ovate, abrupt at the base, taper-pointed at the apex, long-petioled, 10-15 cm. long, 4-7 cm. broad; flowers 2 cm. long, narrowly funnelform; fruit a small, purple berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2911*.

Range: Trinidad and the Guianas and the west coast of Panama.

I. SOLANUM Linnæus

Stems armed:

Leaves nearly as broad as long, broadly notched.....1. *S. torvum*

Leaves ovate to elliptic, entire or shallowly lobed:

Spines straight or only slightly curved.....2. *S. heterophyllum*

Spines decidedly curved.....3. *S. subinerme*

Stems not armed:

Fruit black or yellow:

Plant stellate-scabrous; leaves large, 15 cm. long, ovate.....4. *S. rugosum*

Plant glabrous, or somewhat pubescent with simple hairs; leaves small, 4 cm.

long, lanceolate-ovate.....5. *S. nigrum*

Fruit white.....6. *S. leucocarpum*

1. **Solanum torvum** Swartz, Prodrum Descriptionum Vegetabilium

Indiæ Occidentalis 47. 1788.

TURKEY BERRY

Solanum daturæfolium Dunal, in DeCandolle, Prodrum Systematis Naturalis Regni Vegetabilis 13¹: 261. 1852.

Solanum torvum var. *daturifolium* O. E. Schulz, in Urban, Symbolæ Antillanæ 6: 236. 1909.

A stellate-pubescent shrub 1-4 m. high, armed with short, nearly straight prickles; leaves 7-25 cm. long, broadly ovate, sinuate-lobate, prickly sometimes on the petiole and midrib beneath; flowers white, 10-15 mm. long, in short, stalked, small cymes; fruit a berry, globose, yellow, 1-1.5 cm. in diameter.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 221*.

Range: Cosmopolitan in the tropics.

2. **Solanum heterophyllum** Lamarck, Illustrationes des Genres 2: 22. 1791.

Solanum Juripeba L. C. Richard, Actes de la Société d'Histoire Naturelle de Paris 1: 107. 1792.

A shrub, armed with stout, straight or slightly recurved prickles; leaves scabrous, ovate-elliptic 10-18 cm. long, 3-8 cm. broad, acuminate at the apex, the petioles armed; flowers purple, 4 cm. broad, in compound cymes; fruit a berry 1-1.5 cm. in diameter.

Graham 106 was tree-like, 3 m. high, with blue flowers, found in a second growth jungle clearing.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 106*.

Range: American tropics.

3. ***Solanum subinerme*** Jacquin, Enumeratio Plantarum quas in Insulis Caribæis 15. 1760.

A shrub 1-3 m. high, very prickly with stout, recurved spines; leaves ovate or elliptic, entire or shallowly lobed, somewhat scabrous; flowers purple, 3 cm. broad; fruit a berry.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2934*.

Range: West Indies and the Guianas.

4. ***Solanum rugosum*** Dunal, in DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 13¹: 108. 1852.

Solanum asperum Vahl, Eclogæ Americanæ 2: 17. 1798; not *S. asperum* L. C. Richard 1792.

A stout, unarmed, stellate-scabrous shrub up to 8 m. high; leaves elliptic to obovate, entire, tapering at both ends, 15-30 cm. long, 6-8 cm. broad; flowers white, 1-2 cm. broad, in dense, terminal, corymbiform clusters; fruit a yellow, spherical berry 1 cm. in diameter.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2938*.

Range: West Indies to Brazil.

5. ***Solanum nigrum*** Linnæus, Species Plantarum 186. 1753.

BLACK NIGHTSHADE

Solanum caribæum Dunal, in DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 13¹: 48. 1852.

An annual herb 3-8 dm. high, puberulent or glabrous, unarmed; leaves 2-8 cm. long, ovate-elliptic, sinuate-dentate or entire; flowers small, white or bluish in umbels; fruit a globose, black berry on nodding pedicels, 8-10 mm. in diameter.

The leaves of the young shoots are used as pot herbs like spinach. In the United States the berries are reputed poisonous, but cultivated

varieties are used in pies and preserves and are known as Garden Huckleberry and Wonderberry.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1664*.

Range: Nearly throughout the temperate and tropical regions, consisting of many slightly differing races.

6. *Solanum leucocarpon* L. C. Richard, in Dunal, *Solanorum Generumque Affinium Synopsis* ed. 2. 21. 1816.

An almost glabrous, unarmed shrub; leaves alternate, twinned, thin, ovate-elliptic, entire or somewhat lobed, the larger 3 times as large as its companion, the smaller orbicular; flowers white in few-flowered unilateral cymes, opposite the leaves; fruit a berry, spherical, shiny, white.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 93*.

Range: Tropical America.

III. SCROPHULARIACEÆ. Figwort Family

Leaves less than 5 cm. long; flowers not showy:

Flowers on long pedicels; leaves linear to narrowly spatulate. . . . 1. *SCOPARIA*

Flowers on short pedicels or sessile; leaves broadly ovate-spatulate.

2. *ACHETARIA*

Leaves more than 5 cm. long; flowers showy. 3. *ANGELONIA*

I. SCOPARIA Linnæus

1. *Scoparia dulcis* Linnæus, *Species Plantarum* 116. 1753.

An erect, much branched herb, often 1 m. high or more, glabrous or nearly so; leaves opposite or verticillate, ovate-linear to narrowly spatulate, toothed, 1-3 cm. long, 3-6 cm. broad; flowers small, white, solitary or clustered, on slender pedicels, in the axils of the leaves; fruit capsular, 2 mm. broad.

In the West Indies it is claimed that the branches of this plant if placed in drinking water will keep it cool as if iced.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1958*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2949*.

Range: Florida, Georgia and Texas in the United States and in the tropics of both hemispheres; a very common weed in tropical America.

2. *ACHETARIA* Chamisso and Schlechtendal

1. *Achetaria scutellarioides* (Benth) O. Kuntze, *Revisio Generum Plantarum* 2: 456. 1891.

Beyrichia scutellarioides Benth, *Scrophularineæ Indicæ* 9. 1835.

Achetaria scutellarioides Wettstein, in Engler and Prantl, *Die Natürlichen Pflanzenfamilien* 4^{3b}: 74. 1891.

A woody herb about 1 m. high; leaves opposite, ovate-spatulate, crenate, tapering from the middle into the petiole, 1-4 cm. long, .5-2 cm. broad; flowers white, small, nearly sessile in the axils of the leaves; fruit capsular.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1574.

Range: Brazil, the Guianas and Trinidad.

3. *ANGELONIA* Humboldt and Bonpland

1. *Angelonia salicariæfolia* Humboldt and Bonpland, *Plantæ æquinoctiales* 2: 92. pl. 108. 1809.

An erect, glandular pubescent herb 3-6 dm. high; leaves lanceolate to linear, 3-10 cm. long, the upper much smaller, sub-sessile, coarsely dentate; flowers on slender pedicels; blue, 1.5-2 cm. broad, in leafy-bracted, often elongate racemes; fruit a globose capsule, about 6 mm. in diameter.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3061.

Range: West Indies, Trinidad, and northern South America.

Vandellia diffusa Linnæus, a low, annual, branched herb with white flowers is reported by Beebe (1925) to occur under the Mangroves along the Cuyuni shore. It is a low, frequently prostrate annual with short-petioled, rounded, shallowly crenate leaves and white flowers 6-7 mm. long which are nearly sessile in the axils of the leaves.

112. *BIGNONIACEÆ*. Trumpet Creeper Family

Fruit capsular, dehiscent:

Plants scandent, tendrils present:

Corolla tube more than 5 cm. long; disk none.....1. *CYDISTA*

Corolla tube less than 5 cm. long; disk present, cup-like...2. *ARRABIDÆA*

Plants erect, tendrils not present:

Leaves bipinnate.....3. *JACARANDA*

Leaves simple.....4. *TABEBUIA*

Fruit indehiscent.....5. *SCHLEGELIA*

I. CYDISTA Miers

1. **Cydista æquinocialis** (Linnæus) Miers, Proclamations of the Royal Horticultural Society 3: 191. 1863.

Bignonia æquinocialis (Linnæus), Species Plantarum 623. 1753.

Bignonia spectabilis Vahl, Symbolæ Botanicæ 3: 80. 1794.

A large, woody vine; leaves opposite, compound; leaflets 2 and with or without a tendril representing the third leaflet, oblong-elliptic to ovate, 7-15 cm. long, coriaceous, acute, glabrous or pubescent; corolla pink or pale purple, lepidote outside, 6-8 cm. long; fruit a capsule, linear, 25-40 cm. long, the seeds winged.

The tough, flexible stems of this and other vines of the family are used in the tropics like twine. The leaves when crushed smell like garlic.

Graham 307 is referred to this species although it is not typical. The leaflets are ovate-orbicular, the flowers deep purple and the calyx only 3-4 mm. long instead of 8 mm. as in *C. æquinocialis*.

Vicinity of Kartabo, July 17, 1924, *Graham 274*; vicinity of Kartabo, July 21, 1924, *Graham 307*; along Camaria road, Cuyuni River, July 23, 1924, *Graham 322*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1866*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1992*.

Range: American tropics.

2. ARRABIDÆA DeCandolle

Leaves 3-foliolate; under surface of leaflets glabrous, rose-purple or copper colored.

1. *A. Chica*

Leaves 2-foliolate; under surface of leaflets densely tomentose, white.

2. *A. candicans*

1. **Arrabidæa Chica** (Humboldt and Bonpland) Verlot, Revue Horticole 40: 154. 1868.

Bignonia Chica Humboldt and Bonpland, Plantæ Æquinoctiales 1: 107. 1808.

Adenocalymna portoricensis Stahl, Estudios Para la Flora de Puerto Rico 6: 186. 1888.

A large, woody vine; leaves opposite, tri- to sometimes quinque-foliolate; leaflets ovate to oblong-lanceolate, 4-8 cm. long, 3-5 cm. broad; panicles several- to many-flowered, longer than the leaves, the flowers 15 mm. long, the calyx puberulent, 5 mm. long; fruit a capsule, elongated, smooth.

Graham 291 is referred to this species although the flowers are 30-40

mm. long instead of 15 mm. Otherwise the specimen seems to agree with *A. Chica*.

Vicinity of Kartabo, July 18, 1924, *Graham 291*.

Range: Continental tropical America, Trinidad.

2. **Arrabidaea candicans** DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 9: 185. 1845.

A large vine; leaves opposite, bifoliolate; leaflets ovate-elliptic, acute or rounded at the apex, whitish below, 8-10 cm. long, 3-6 cm. broad; flowers 2-3 cm. long, lavender, in large, compound, terminal racemes; fruit a capsule, linear, 15-20 cm. long.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham 149*.

Range: Guianas.

3. JACARANDA A. L. Jussieu

1. **Jacaranda filicifolia** (Anderson) D. Don, *Edinburgh Philosophical Journal* 266. 1823.

Bignonia filicifolia Anderson, *Transactions of the Society Instituted in London for the Encouragement of the Arts etc.* 25: 200. 1807.

A large tree; leaves opposite, abruptly bipinnate, composed of numerous small, entire leaflets, the petiolules winged; flowers large, 3-4 cm. long, showy; fruit a capsule, compressed, ovate-oblong, containing broadly winged seeds.

Graham 341 was 10 m. high, found along a rocky river bank.

Matope, Cuyuni River, July 23, 1924, *Graham 341*.

Range: Panama and the Guianas.

Jacaranda Copaia D. Don, the Fotui, Phootee, or Futui, is reported by Zon and Sparhawk (1923) as a timber tree of the colony with very soft, coarse-grained wood, something like White Pine, used for rough lumber, matches and match boxes.

Jacaranda ovalifolia R. Brown, the Wakenaam Lilac, is reported from the region by British Empire Exhibition (1924). It sheds its leaves before flowering, when the pale lilac flowers show conspicuously, and as the flowers fall the new leaves appear.

4. TABEBUIA Gómez

1. **Tabebuia longipes** Baker, in Hooker, *Icones Plantarum* 18: pl. 1738. 1888. WHITE CEDAR, WARAKURI

A glabrous tree; leaves opposite, ovate-elliptic, tapering at both ends, acuminate, leathery, long-petioled; flowers large, about 6 cm.

long, arranged in terminal, corymb-like panicles; fruit a capsule, linear, 12-16 cm. long or more.

This tree is usually found in swamps, along streams, and is considered the best wood of the colony for foundations, oars and paddles; it is fairly soft and easy to work.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1940; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2905.

Range: British Guiana.

Species of **Tabebuia**, **Tecoma**, or *Siderodendron* (the latter of the Rubiaceæ q.v.) are known as Hackia or Ironwood, according to Zon and Sparhawk (1923) and are native to the colony. They are large trees with brown, close-grained, hard and heavy wood which is substituted for Lignum Vitæ in the construction of hammers, handles, cogs, etc.

5. SCHLEGELIA Miquel

1. **Schlegelia elongata** Miquel, Linnæa 22: 73. 1849.

A heavy, glabrous vine; leaves opposite, ovate to oblong, entire, hard and leathery, 10-15 cm. long, 6-8 cm. broad; flowers pink-purple, in long, simple, terminal racemes; fruit globose, hard, indehiscent; seeds small and wingless.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1613.

Range: Guianas.

Crescentia Cujete Linnæus, the Calabash, has a fruit which forms gourds used for carrying water and other liquids. The outer skin and inner pulp are removed, leaving the woody shell as the gourd. By tying the fruit as it grows, it may be trained to assume various shapes. Species of the cucurbitaceous genus *Lagenaria* are also called Calabash.

113. GESNERIACEÆ. Gesneria Family

1. EPISCIA Martius

1. **Episcia mimuloides** Bentham, London Journal of Botany 5: 362. 1846.

A flaccid, pilose herb; leaves opposite, thin, ovate-elliptic, acuminate, crenate; flowers white, showy, 4 cm. long; fruit a capsule.

Trailing, along Camaria road, Cuyuni River, July 31, 1924, *Graham* 397.

Range: Guianas.

114. LENTIBULARIACEÆ. Bladderwort Family

1. UTRICULARIA Linnæus

- Branches verticillate, and verticillately or oppositely decompound; lateral lobes of the lower lip of the corolla saccate.....1. *U. myriocista*
 Branches alternate or none; lateral lobes of the lower lip of the corolla not saccate:
 Pedicels recurved; peduncles arising singly from the nodes of elongate floating stems.....2. *U. mixta*
 Pedicels erect or ascending; peduncles solitary, slender, the stems radiating from their bases.....3. *U. obtusa*

1. *Utricularia myriocista* A. St. Hilaire and Girard, Annales des Sciences Naturelles, II. 11: 150. 1839.

An aquatic herb with verticillately or oppositely decompound branches; bladders terminal on the ultimate branches; leaves none, at least in the adult plant; inflorescence racemose, 1-4 flowered, scales none on the lower part of the scape; fruit a many-seeded capsule.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1881.

Range: Throughout the tropics.

2. *Utricularia mixta* Barnhart, Memoirs of the Torrey Botanical Club 16: 111. 1920.

A floating plant with slender stem, swimming by means of bladders; leaves large, dissected into thread-like segments; flowers yellow in spike-like racemes on elongate scapes; fruit a small capsule.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1942.

Range: West Indies and Guiana.

3. *Utricularia obtusa* Swartz, Prodröm Descriptionum Vegetabilium Indiæ Occidentalis 14. 1788.

A floating plant with slender stem, swimming by means of bladders; leaves large, dissected into thread-like segments; flowers in loosely branching racemes; fruit capsular.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2434.

Range: American tropics.

115. ACANTHACEÆ. Acanthus Family

Stamens 4:

Plants scandent; seeds 1-4, borne on retinacula (projections from the placenta) which are papilliform:

Fruit drupaceous, 1-seeded.....1. *MENDONCIA*

Fruit capsular, 2-4 seeded.....2. *THUNBERGIA*

Plants not scandent, usually erect; seeds few and borne on hook-like retinacula, or numerous and borne on papilliform retinacula:

Plants shrubs; corolla red.....3. *APHELANDRA*

Plants usually herbaceous, corolla yellow or purple4. *LEPIDAGATHIS*

Stamens 2:

Corolla with 4 sub-equal lobes; staminodia 2.....5. *ODONTONEMA*

Corolla 2-lipped; staminodia none.....6. *JUSTICIA*

1. *MENDONCIA* Vellozo

1. *Mendoncia Schomburgkiana* Nees, in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 11: 51. 1825.

A pilose, woody vine; leaves opposite, thin, entire, broadly ovate, abruptly acuminate at the apex, 8-15 cm. long, 3-6 cm. broad; flowers red, axillary, on pedicels 5-8 cm. long; fruit a drupe.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1865.

Range: Brazil and the Guianas.

2. *THUNBERGIA* Retzius

1. *Thunbergia grandiflora* Roxburgh, *Hortus Bengalensis* 45. 1814; *Flora Indica* 3: 34. 1832.

A long, woody vine; leaves opposite, triangular-ovate, irregularly angularly lobed, attenuate at the apex, angular-cordate at the base up to 15 cm. long; flowers white to blue or purple, about 8 cm. long, arranged in elongate racemes; fruit an abruptly beaked coriaceous capsule.

Vining over second growth, Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 125.

Range: Native to the East Indies; cultivated in the American tropics for its showy flowers.

3. *APHELANDRA* R. Brown

1. *Aphelandra Deppeana* Chamisso and Schlechtendal, *Linnæa* 5: 96. 1830.

Aphelandra pectinata Willdenow, ex Nees in DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 11: 297. 1847.

A smooth shrub 1-3 m. high; leaves opposite, ovate-elliptic to lanceolate-oblong, entire, acuminate, usually pubescent beneath, 8-12 cm. long, 2-4 cm. broad; flowers bright red, 4 cm. long, in dense bracted spikes, the bracts laciniate, appressed; fruit a sessile, 4-seeded capsule.

Matope, Cuyuni River, July 23, 1924, *Graham* 336.

Range: Mexico to northern South America.

4. LEPIDAGATHIS Willdenow

1. **Lepidagathis alopecuroidea** (Vahl) R. Brown, in Grisebach, *Flora of the British West Indian Islands* 453. 1861.

Ruellia alopecuroidea Vahl, *Eclogæ Americanæ* 2: 49. 1798.

Teliostachya alopecuroidea Nees in Martius, *Flora Brasiliensis* 9: 72. 1847.

A small, perennial herb; leaves opposite, ovate-elliptic, short-pilose, 3-8 cm. long, obtuse or acute at the apex, the base narrowed; flowers small, white to purple, in mostly terminal, dense many-flowered spikes, 1 cm. thick; bracts narrow hispidulous and strongly nerved; fruit a capsule, sessile, glabrous, 4-seeded, about 4 mm. long.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2621.

Range: Continental tropical America.

5. ODONTONEMA Nees

1. **Odontonema Schomburgkianum** (Nees) O. Kuntze, *Revisio Generum Plantarum* 2: 494. 1891.

Thysacanthus Schomburgkianus Nees, *London Journal of Botany* 4: 636. 1845.

A large herb or shrub, glabrous or nearly so; leaves opposite, ovate-elliptic, caudate-acuminate at the apex, tapering at the base, 10-15 cm. long, 4-6 cm. broad; flowers red, handsome, in raceme-like, terminal panicles; fruit an oblong, stipitate capsule.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2989.

Range: Guianas.

6. JUSTICIA Linnæus

Inflorescence filiform-spicate or paniculate; flowers small, 6-10 mm. long; leaves 1-3 cm. long.....1. *J. pectoralis*

Inflorescence densely spicate or flowers solitary; flowers large, 3-6 cm. long; leaves 8-20 cm. long.....2. *J. secunda*

1. **Justicia pectoralis** Jacquin, Enumeratio Plantarum quas in Insulis Caribæis II. 1760.

Dianthera pectoralis J. F. Gmelin, in Linnæus, Systema Vegetabilium ed. 13. 36. 1791.

Stethoma pectoralis Rafinesque, Flora Telluriana 4: 61. 1838.

Ecbolium pectorale O. Kuntze, Revisio Generum Plantarum 487. 1891.

A low, slender herb, short pilose, erect, decumbent or ascending; leaves opposite, lanceolate to ovate-lanceolate, acuminate to attenuate at the apex, about 2 cm. long; flowers pink, 6-10 mm. long, distant, in branched, mostly one-sided, terminal, elongated spikes; fruit a capsule, apparently rarely formed.

Trailing over rocks, Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 232.

Range: Continental tropical America.

2. **Justicia secunda** Vahl, Symbolæ Botanicæ 2: 7. 1791.

Dianthera secunda Grisebach, Abhandlungen der Königl. Gesellschaft der Wissenschaften zu Göttingen 7: 246. 1857.

Ecbolium secundum O. Kuntze, Revisio Generum Plantarum 488. 1891.

A large herb or shrub up to 2-3 m. high; leaves opposite, long-petioled, lanceolate-ovate to elliptic, 8-20 cm. long, 3-8 cm. broad; flowers conspicuous, red, in dense, terminal, narrow panicles, corolla 3-6 cm. long; fruit an oblong or obovate capsule.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1566; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2610.

Range: Panama and northern South America.

116. RUBIACEÆ. Madder Family¹²

a. Ovules 3 or more in each cell of the ovary:

b. Fruit dry:

c. Corolla lobes imbricated or contorted, never valvate.....1. *SIPANEA*

cc. Corolla lobes valvate.....2. *OLDENLANDIA*

bb. Fruit fleshy:

c. Corolla lobes valvate:

d. Inflorescence terminal.....3. *DUGGENA*

dd. Inflorescence axillary:

e. Plants creeping, herbaceous.....4. *COCCOCYPSELUM*

ee. Plants not creeping, shrubs.....5. *SABICEA*

¹²Key to the genera of the Rubiaceæ adapted chiefly from Standley (1930).

- cc. Corolla lobes imbricate or contorted:
 - d. Seeds many, minute, pitted or rarely tuberculate. . . . 6. *BERTIERA*
 - dd. Seeds usually few and large, the testa smooth or fibrous:
 - e. Flowers perfect:
 - f. Inflorescence terminal or terminal and axillary. . . 7. *POSOQUERIA*
 - ff. Inflorescence lateral. 8. *GENIPA*
 - ee. Flowers diœcious, staminate and pistillate flowers both in cymes.
 - 9. *AMAIIOUA*
- aa. Ovules 1 or 2 in each cell of the ovary:
 - b. Ovules pendulous. 10. *MALANEA*
 - bb. Ovules erect or ascending:
 - c. Ovules affixed to the base of the ovary:
 - d. Ovary 1-celled, or 2-celled but with a very thin septum.
 - 11. *FARAMEA*
 - dd. Ovary with 2 or more cells, the septum thick:
 - e. Ovary superior. 12. *PAGAMEA*
 - ee. Ovary inferior:
 - f. Inflorescence an involucrate head. 13. *CEPHÆLIS*
 - ff. Inflorescence without an involucre, usually not in heads:
 - g. Stipules not pectinate, or rarely so; seeds deeply furrowed or flat on the inner side:
 - h. Corolla tube not gibbous at the base; inflorescence usually not thyrsoïd. 14. *PSYCHOTRIA*
 - hh. Corolla tube gibbous at the base; inflorescence usually thyrsoïd. 15. *PALICOUREA*
 - gg. Stipules pectinate; seed with inrolled ventral surface.
 - 16. *RUDGEA*
 - cc. Ovules affixed to the septum:
 - d. Stipules entire, not leaflike; plants shrubs or trees, the flowers in dense heads. 17. *APPUNIA*
 - dd. Stipules fimbriate or leaflike; plants chiefly herbaceous:
 - e. Cocci indehiscent. 18. *DIODIA*
 - ee. Cocci dehiscent, at least one of them. 19. *BORRERIA*

I. SIPANEA Aublet

1. *Sipanea pratensis* Aublet, Histoire des Plantes de la Guiane
Françoise 1: 147. pl. 56. 1775. MAZARUNI PRIMROSE

Sipanea dichotoma Humboldt, Bonpland and Kunth, Nova Genera et Species
Plantarum 3: 397. 1820.

A pubescent, annual herb; leaves opposite, ovate to ovate-elliptic or lanceolate-elliptic, tapering at both ends, 3-8 cm. long, 1-3 cm. broad, sessile or short-petiolate; flowers sessile, white to pink or red, in terminal cymes, corolla tube 8-12 mm. long; fruit a capsule 5-8 mm. long, with minute seeds.

This plant is a common one about Kartabo on the floor of the clearings and on little-used trails where it grows as a prostrate trailer.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 101*; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1578*; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1603*; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz 1604*; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1860*; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz 2630*.

Range: Trinidad, Guianas and Venezuela.

2. OLDENLANDIA Linnæus

1. **Oldenlandia herbacea** (Linnæus) DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 4: 425. 1830.

Hedyotis herbacea Linnæus, *Species Plantarum* 102. 1753.

A glabrous annual; leaves opposite, linear, 2-7 cm. long, 1-nerved; flowers white, 1.5 cm. long, solitary or clustered in the leaf-axils, on long, filiform peduncles; fruit a capsule, globose to globose-depressed, 2-4 mm. long.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz 1956*.

Range: Widely distributed throughout the tropics of both hemispheres.

3. DUGGENA Vahl

1. **Duggena hirsuta** (Jacquin) Britton, *Scientific Survey of Porto Rico and the Virgin Islands* 6²: 229. 1925.

Justicia hirsuta Jacquin, *Enumeratio Systematica Caribæis* 11. 1760.

Barleria hirsuta Jacquin, *Observationum Botanicarum* 2: 7. pl. 32. 1767.

Lygistum spicatum Lamarck, *Tableau Encyclopédique, Botanique* 1: 286. 1791.

Duggena Richardii Vahl, in West, *Bidrag til Beskrivelse over Ste Croix, etc.* 269. 1793.

Coccocypselum spicatum Humboldt, Bonpland and Kunth, *Nova Genera et Species Plantarum* 3: 406. 1820.

Gonzalea spicata DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 4: 437. 1830.

Duggena spicata Standley, *Contributions from the U. S. National Herbarium* 18: 126. 1916.

A shrub or small tree about 3 m. high; leaves opposite, elliptic-oblong to ovate-lanceolate, tapering at both ends, somewhat broader

below the middle, 6-18 cm. long; flowers small, white, 10-15 mm. long, pubescent, in elongate, spike-like panicles; fruit a drupe, white or blue, 3-4 mm. in diameter, 2-celled, pubescent.

Along Camaria road, Cuyuni River, July 30, 1924, *Graham* 380.

Range: West Indies and northern South America.

4. COCCOCYPSELUM Schreber

1. **Coccocypselum guianense** (Aublet) C. Schumann, in Martius, *Flora Brasiliensis* 6^b: 315. 1889.

Tontanea guianensis Aublet, *Histoire des Plantes de la Guiane Française* 1: 108. 1775.

An hirsute, creeping herb; leaves opposite, 1.5-4 cm. long and about as broad, petioled, ovate-triangular, acute at the apex, decurrent at the base; flowers small, blue, in long-peduncled, axillary heads; fruit a berry, blue, 6-11 mm. in diameter.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1634; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1991.

Range: Widely distributed in tropical America.

5. SABICEA Aublet

1. **Sabicea aspera** Aublet, *Histoire des Plantes de la Guiane Française* 1: 194. pl. 76. 1775.

Sabicea glabrescens Benthham, in Hooker, *Journal of Botany* 3: 219. 1841.

An hirsute shrub; leaves opposite, ovate-elliptic, 5-8 cm. long, 2-4 cm. broad, decurrent at the base, acuminate at the apex; flowers white, sessile or nearly so, in dense, axillary clusters, the calyx spinulose-hairy; fruit a berry.

Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2638; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3038.

Range: Trinidad, Guianas, and Amazon valley.

6. BERTIERA Aublet

1. **Bertiera guianensis** Aublet, *Histoire des Plantes de la Guiane Française* 1: 180. pl. 69. 1775.

A slender shrub; leaves opposite, short-petioled, ovate-oblong or ovate-elliptic, acuminate, appressed-pilose, 9-15 cm. long; flowers small, white, in terminal panicles; fruit a globose, 10-costate berry, 3-5 mm. in diameter.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1936.

Range: Widely distributed in tropical America, usually at low elevations.

7. POSOQUERIA Aublet

Corolla lobes 3-4 cm. long, tube 25-35 cm. long; stipules linear to lanceolate-acuminate. 1. *P. longiflora*

Corolla lobes 2-2.5 cm. long, tube 8-20 cm. long; stipules broadly triangular.

2. *P. latifolia*

1. **Posoqueria longiflora** Aublet, *Histoire des Plantes de la Guiane Françoise* 1: 134. 1775.

A glabrous, shrubby vine; leaves opposite, ovate-oblong to elliptic, tapering from near the base to the slender, acuminate apex, 12-18 cm. long, 4-7 cm. broad; flowers white, in dense, terminal cymes; corolla tube 25-35 cm. in length, pendent, conspicuous and handsome; fruit a fleshy berry.

Graham 253 was found hanging from trees along a small creek in dense jungle.

Vicinity of Kartabo, July 14, 1924, *Graham* 253.

Range: Guianas.

2. **Posoqueria latifolia** (Rudge) Rømer and Schultes, *Systema Vegetabilium* 5: 227. 1819.

Solena latifolia Rudge, *Plantarum Guianæ Rariorum* 1: 26. 1806.

A glabrous shrub or vine 6 m. long; leaves opposite, ovate, or oblong, 8-20 cm. long, 4-10 cm. broad, acute or short acuminate at the apex, leathery; flowers white, in dense, terminal racemes or cymes, the corolla tube slender, 8-20 cm. long; fruit a berry, globose, 4-5 cm. in diameter, yellow, full of large seeds.

Graham 271 was a heavy vine found along the river's edge. The fleshy fruit is considered edible, but is of poor quality.

Vicinity of Kartabo, July 17, 1924, *Graham* 271.

Range: American tropics.

8. GENIPA Linnæus

1. **Genipa americana** Linnæus, *Systema Naturæ*, ed. 10, 2: 931. 1759.
GENIP TREE, GENIPA, JAGUA, MAKREEKONEE

A tree 6-14 m. high; leaves opposite, obovate, short-petioled, glabrous, obtuse or short acuminate at the apex, 1-3.5 dm. long;

flowers yellowish-white, 2-4 cm. long, in small, terminal cymes; fruit a berry, globose, brownish, 6-7 cm. in diameter, the pulp filled with numerous, large, compressed seeds.

The fruit is edible, and makes a refreshing drink; the juices are used in making a brown dye and fermented into an intoxicating liquor. The wood is strong and resistant, flexible, whitish, tinged with gray, and useful for many purposes. The bark is rich in tannin.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1961*.

Range: Tropical America.

9. AMAIOUA Aublet

1. **Amaioua corymbosa** Humboldt, Bonpland, and Kunth, Nova Genera et Species Plantarum 3: 419. pl. 294. 1818.

Gardenia hexandra Willdenow, in Rœmer and Schultes, Systema Vegetabilium 5: 243. 1819.

A shrub 3-9 m high; leaves whorled, short-petioled, ovate-elliptic, tapering at the base, long acuminate at the apex, 15-25 cm. long, 5-10 cm. broad, slightly pubescent, especially on the nerves beneath; flowers usually unisexual, in peduncled, terminal clusters, densely pubescent; fruit a small, dry berry, black, 1.5 cm. long.

Vicinity of Bartica, on the Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1918*.

Range: Central America, Cuba, Trinidad, Guianas and Venezuela.

Amaioua guianensis Aublet is known from the Guianas, according to Standley (1930).

10. MALANEA Aublet

Leaves generally more than 10 cm. long, broadly ovate. 1. *M. macrophylla*
Leaves generally less than 10 cm. long, ovate-elliptic to elliptic-lanceolate.

2. *M. obovata*

1. **Malanea macrophylla** Bartling, in Schomburgk, Versuch einer Fauna und Flora von Britisch-Guiana 947. 1848; in Grisebach, Flora of the British West Indian Islands 337. 1861.

A glabrate shrub; leaves opposite, thick, broadly ovate to ovate-elliptic, 10-25 cm. long, acute at the apex, somewhat abrupt at the base; flowers small, clustered in axillary panicles, hoary-sericeous, the corolla pubescent; fruit a drupe, fleshy.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2670; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3021.

Range: West Indies and the Guianas.

2. **Malanea obovata** Hochreutiner, Bulletin of the New York Botanical Garden 6: 289. 1910.

A pubescent shrub; leaves opposite, ovate-elliptic to elliptic-lanceolate, 6-12 cm. long, 3-5 cm. broad, leathery, conspicuously veined; flowers small, in axillary panicles: fruit a drupe, fleshy.

Vicinity of Wismar, Demerara River, Lat. $6^{\circ} N.$, October 12-16, 1922, *De La Cruz* 2413.

Range: British Guiana.

11. FARAMEA Aublet

1. **Faramea salicifolia** Presl, Symbolæ Botanicae 24. pl. 70. 1833.

A glabrous shrub; leaves opposite, lanceolate-ovate to linear-lanceolate, somewhat crenate, short petioled, 5-12 cm. long, .5-3 cm. broad, cuspidate-acuminate, stipules triangular-attenuate; flowers slender-pedicellate, in terminal cymes; fruits capsular about 8 mm. broad.

Dr. Standley, who identified this specimen, writes that "we have several specimens of this plant from the Guianas, but I have never been able to find an altogether satisfactory name for it. Probably it has not been described."

Vicinity of Kartabo, July 18, 1924, *Graham* 278.

Range: Widely distributed in South America.

12. PAGAMEA Aublet

1. **Pagamea capitata** Bentham, Journal of the Linnæan Society 1: 85. 1857.

A tree; leaves opposite, leathery, lanceolate-elliptic, tapering at the base, wider below the middle, attenuate at the apex, 8-10 cm. long, 2-3 cm. broad; stipules sheathing, bristle-tipped; flowers small, in compact, peduncled heads, peduncles and petioles pubescent; fruit a drupe.

Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2659.

Range: Guianas.

13. CEPHÆLIS Swartz

Plants glabrous. 1. *C. violacea*

Plants pubescent:

Pubescence hirsute throughout, with coarse, spreading hairs . . . 2. *C. tomentosa*

Pubescence tomentose throughout, with dense short hairs. . . 3. *C. bracteocardia*

1. *Cephælis violacea* (Aublet) Willdenow, Species Plantarum 1: 977. 1797.

Tapogomea violacea Aublet, Histoire des Plantes de la Guiane Française 1: 157. pl. 60. 1775.

A glabrous shrub or small tree; leaves opposite, leathery, short-petioled, ovate to elliptic-oblong, 10-20 cm. long; stipules broad, obtuse; flowers in large heads, terminal, sessile; bracts about 5, green or violet; corolla yellowish; fruit a large blue berry.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1896; vicinity of Wismar, Demerara River, Lat. $6^{\circ} N.$, October 12-16, 1922, *De La Cruz* 2458.

Range: Colombia and the Guianas.

2. *Cephælis tomentosa* (Aublet) Vahl, Eclogæ Americanæ 1: 19. 1796. BUSH ROSE

Tapogomea tomentosa Aublet, Histoire des Plantes de la Guiane Française 1: 160. pl. 61. 1775.

Evea tomentosa Standley, Contributions from the U. S. National Herbarium 18: 123. 1916.

A slender shrub 6 m. high or less, copiously hirsute; leaves opposite, lanceolate to ovate-elliptic, long acuminate at the apex; flowers yellow in terminal, pedunculate, dense, many-flowered heads; bracts large, much exceeding the flowers, red, showy; fruit a blue berry.

Hingston (1932) reports a small caterpillar which feeds on the stem of this plant. The insect larva is encased in a conical, hairy case which closely mimics the hirsute stipules of the plant. *Graham* 104 was collected in a thicket of second growth jungle.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham* 104; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1569.

Range: Mexico to Bolivia.

3. **Cephælis bracteocardia** DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 4: 534. 1830.

Cephælis pubescens Hoffmannsegg, in Rœmer and Schultes, *Systema Vegetabilium* 5: 213. 1819.

Psychotria bracteocardia Mueller-Argoviensis, in Martius, *Flora Brasiliensis* 6⁵: 362. 1881.

A tomentose shrub; leaves opposite, elliptic-lanceolate, thin, 15-25 cm. long, 4-6 cm. broad, tapering at both ends, attenuate-acuminate at the apex; flower heads terminal, pedunculate, dense, many-flowered; bracts large, ovate-acuminate, exceeding the flowers; fruit a berry.

Vicinity of Kartabo, July 5, 1924, *Graham* 160.

Range: Brazil and the Guianas.

14. **PSYCHOTRIA** Linnæus

Inflorescence paniculate:

Stipules persistent, longer than the petioles.....1. *P. inundata*

Stipules deciduous:

Panicle flat-topped; leaves elliptic-ovate, narrowly tapering at the base into the petiole wings.....2. *P. Patrisii*

Panicle cone-shaped; leaves ovate to ovate-lanceolate, acute at the base.

3. *P. Mapouria*

Inflorescence densely few-flowered, short pedunculate:

Fruit 1 cm. long, 2-ribbed.....4. *P. axillaris*

Fruit 3-5 mm. long, several-ribbed:

Twigs green.....5. *P. involucrata*

Twigs dark, reddish.....6. *P. Hoffmannseggiana*

1. **Psychotria inundata** Benthām, in Hooker, *Journal of Botany* 3: 229. 1841.

A rather glabrous shrub; leaves opposite, thick, ovate-elliptic, tapering acuminate to cuspidate at the apex, 10-15 cm. long, 3-6 cm. broad, stipules longer than the petioles; flowers white, in terminal, cone-shaped, compound, cymose racemes; fruit a drupe, 2-celled, black.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1659; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz* 2706.

Range: Panama to the Guianas and Amazon valley.

2. **Psychotria Patrisii** DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 4: 510. 1830.

A glabrous shrub; leaves opposite, thick, lanceolate-elliptic, tapering into the petiole, short acuminate at the apex; flowers white, in broad, flat-topped, corymb-like panicles; fruit a drupe, hard, 5-8 mm. in diameter.

Between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1644.

Range: Guianas and Venezuela.

3. ***Psychotria Mapouria*** Rœmer and Schultes, *Systema Vegetabilium* 5: 187. 1819.

Psychotria nitida Willdenow, *Species Plantarum* 1: 963. 1797.

A glabrous shrub 2-4 m. high; leaves opposite, broadly ovate-elliptic, abruptly acuminate at the apex, acute to slightly tapering at the base, short-petioled, 10-20 cm. long, half as broad; flowers white, clustered in large, terminal, peduncled panicles; fruit a berry, ovoid-globose.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 35' N.$, September 3-12, 1922, *De La Cruz* 1882.

Range: West Indies and the Guianas.

4. ***Psychotria axillaris*** Willdenow, *Species Plantarum* 1: 962. 1797.

Ronabea latifolia Aublet, *Histoire des Plantes de la Guiane Française* 1: 154. pl. 59. 1775; not *Psychotria latifolia* Humboldt and Bonpland 1819.

A shrub about 2 m. high; leaves opposite, petiolate, elliptic or oblong, 12-15 cm. long, acuminate at the apex, tapering at the base; flowers white, nearly sessile in axillary clusters, scarcely longer than the petioles; fruit a black berry, 1 cm. long.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1938.

Range: Trinidad and northern South America.

5. ***Psychotria involucrata*** Swartz, *Prodromus Descriptionum Vegetabilium Indiæ Occidentalis* 45. 1788; not *P. involucrata* Willdenow 1798.

A slender, nearly glabrous shrub 2 m. high or less; leaves opposite, ovate to elliptic, 4-12 cm. long, acuminate or acute at the apex, contracted and decurrent at the base; inflorescence terminal, pedunculate, the flowers sessile or nearly so, involucre by linear-lanceolate, purplish bractlets 6-8 mm. long; fruit a blue or black berry, globose, 4 mm. long.

Vicinity of Kartabo, July 18, 1924, *Graham* 288; vicinity of Wismar, Demerara River, Lat. $6^{\circ} N.$, October 12-16, 1922, *De La Cruz* 2457; Malali, Demerara River, Lat. about $5^{\circ} 35' N.$, October 30-November 5, 1922, *De La Cruz* 2610.

Range: Widely distributed in tropical America.

6. **Psychotria Hoffmannseggiana** (Rømer and Schultes) Mueller-Argoviensis, in Martius, *Flora Brasiliensis* 6⁵: 336. 1881.

Cephalis Hoffmannseggiana Rømer and Schultes, *Systema Vegetabilium* 5: 214. 1819.

A low shrub; leaves opposite, ovate-elliptic, cuspidate-acuminate, tapering at the base, 5-8 cm. long, 2-3 cm. broad; flowers small, sessile, generally in cymose heads less than 1 cm. broad, the peduncles hairy; bracts exceeding the flowers in length; fruit a purple, compressed, globose berry, 3 mm. long.

Vicinity of Kartabo, July 1924, *Graham* 92; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1639.

Range: Venezuela, the Guianas and Amazon valley.

15. PALICOUREA Aublet

Leaves mostly in whorls of 3, pubescent below.....1. *P. triphylla*

Leaves mostly opposite, glabrous below:

Stipules 6-10 mm. long; leaves large, 10-30 cm. long.....2. *P. guianensis*

Stipules less than 6 mm. long; leaves less than 10 cm. long.....3. *P. riparia*

1. **Palicourea triphylla** DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 4: 526. 1830.

Psychotria triphylla Mueller-Argoviensis, in Martius, *Flora Brasiliensis* 6⁵: 233. pl. 32. 1881.

A shrub about 3 m. high; leaves 3-verticillate or opposite, short-petioled, oblong or ovate-oblong, long acuminate at the apex, usually acute at the base, 10-20 cm. long; stipule lobes linear, 6-10 mm. long; inflorescence long-pedunculate, in a narrowly pyramidal thyrsoid panicle, dense, many-flowered; pedicels and calyx red; the corolla red or yellow, 12-18 mm. long; fruit a black drupe.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1605.

Range: Widely distributed in tropical America from Central America and Trinidad to Bolivia.

2. **Palicourea guianensis** Aublet, *Histoire des Plantes de la Guiane Française* 1: 173. pl. 66. 1775.

Psychotria guianensis Rusby, *Memoirs of the Torrey Botanical Club* 3³: 48. 1893.

A nearly glabrous shrub or small tree; leaves opposite, short-petioled, thin, up to 30 cm. long, 15 cm. broad, elliptic-oblong to

broad-ovate or elliptic, acuminate at the apex; flowers in large, dense, many-flowered, thyrsoïd or pyramidal panicles, usually densely furfuraceous-tomentose; corolla yellow or orange red, 10-18 mm. long; fruit an ovoid drupe, 4-5 mm. long.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1638; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1864.

Range: Widely distributed in South America.

3. **Palicourea riparia** Benthām, in Hooker, *Journal of Botany* 3: 224. 1841.

A glabrous shrub or small tree 1-6 m. high; leaves opposite, elliptic to ovate, 8-15 cm. long, 2-4 cm. broad; flowers red or yellow, 12-18 mm. long, in many-flowered thyrsoïd panicles; fruit a broadly ovate, compressed, black drupe 5 mm. long, the pyrenes crested.

Vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz* 2435; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2990.

Range: West Indies and South America.

16. RUDGEA

1. **Rudgea Hostmannianum** Benthām, *Linnæa* 23: 459. 1850.

A glabrous shrub or small tree; leaves opposite, thick, leathery, elliptic to lanceolate-elliptic, acute at the apex, tapering at the base into a short petiole, 15-20 cm. long, 5-7 cm. broad; flowers in loose, axillary, cymose panicles; fruit a drupe, obovoid, ridged, 7-10 mm. in diameter, black or blue.

Vicinity of Kartabo, July 21, 1924, *Graham* 308.

Range: Guianas.

17. APPUNIA Hooker filius

1. **Appunia debilis** Sandwith, *Kew Bulletin*, 1931: 471. 1931.

A shrub; leaves opposite, oblong-elliptic to lanceolate-elliptic, 10-30 cm. long, 3-8 cm. broad, cuneate at the base, abruptly acuminate at the apex; flowers in dense, sessile heads at the tip of axillary flexuose peduncles 8-10 cm. long, ultimately divided; fruit an oblong-ellipsoid berry 7-10 mm. long.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1647.

Range: British Guiana.

18. *DIODIA* Linnæus

1. *Diodia sarmentosa* Swartz, Prodrömus Descriptionum Vegetabilium Indiæ Occidentalis 30. 1788.

A shrubby, vine-like perennial; leaves opposite, oblong-lanceolate to elliptic, scabrous above, strongly pinnately veined, 3-7 cm. long, tapering at both ends; flowers white, solitary or few in the axils of the leaves; fruit 2-celled, hard, ovoid-oblong, 3-5 mm. in diameter, finally separating into 2 indehiscent carpels.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3050.

Range: West Indies, continental American tropics and the old world tropics.

19. *BORRERIA*

Leaves small, 1-3 cm. long.....1. *B. ocimoides*
Leaves large, 4-8 cm. long:

Leaves lanceolate to linear, dark green.....2. *B. capitata*
Leaves ovate to elliptic, light green.....3. *B. latifolia*

1. *Borreria ocimoides* (Burmamn filius) DeCandolle, Prodrömus Systematis Naturalis Regni Vegetabilis 4: 544. 1830.

Spermacoce ocimoides Burmann filius, Flora Indica 34. pl. 13, f. 1. 1768.

Borreria parviflora G. F. W. Meyer, Primitiæ Floræ Essequibœnsis 83. pl. 1. 1818.

A slender, branched annual 6 dm. high or less, the stems glabrous or puberulent on the angles; leaves opposite, linear to oblong-lanceolate or the lower spatulate, 1-3 cm. long; flowers white, minute, in dense, axillary clusters, the stamens included; calyx lobes 4 in number, subulate; fruit capsular, glabrous or puberulent, 1 mm. long.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2948; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3012.

Range: Common weed from Cuba and Mexico through the West Indies and continental tropical America to northern Argentine. Also in Africa and Asia.

2. *Borreria capitata* (Ruiz and Pavon) DeCandolle, Prodrömus Systematis Naturalis Regni Vegetabilis 4: 545. 1830.

Spermacoce capitata Ruiz and Pavon, Flora Peruviana et Chilensis 1: 61. pl. 91. f. b. 1798.

Spermacoce ferruginea St. Hilaire, Plantes Usuelles des Bräsilienſ pl. 13. 1824.

Borreria ferruginea DeCandolle, Prodrömus Systematis Naturalis Regni Vegetabilis 4: 547. 1830.

A woody herb, about 1 m. high, stems narrowly winged above, glabrous or pubescent on the angles; leaves lanceolate to linear, tapering at both ends, 3-8 cm. long, stipules with cilia 1 cm. long; flowers small, white, verticillate, in dense, axillary heads, 2 cm. in diameter when in fruit; flowering nodes distant; fruit capsular, puberulent at the apex.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 118*; Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham 220*; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz 1912*; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5, 1922, *De La Cruz 2657*; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz 2924*.

Range: Widely distributed in South America.

3. **Borreria latifolia** (Aublet) Schumann, in Martius, *Flora Brasiliensis* 6⁶: 61. pl. 80. 1888.

Spermacoce latifolia Aublet, *Histoire des Plantes de la Guiane Française* 1: 55. pl. 19, f. 1. 1775.

An annual or perennial herb with stems narrowly winged above, glabrous or pubescent on the angles; leaves broadly elliptic, acute at the apex, thick, conspicuously nerved, slightly scabrous above, puberulent beneath, at least along the nerves, 3-8 cm. long, 1-4 cm. broad; inflorescence verticillate, the small white flowers densely crowded in the axils of the leaves; fruit capsular, puberulent, 1 mm. long.

In dried specimens the plant is easily recognized by the yellow-green color assumed by the leaves and stems.

Kalacoon, vicinity of Kartabo, June 27, 1924, *Graham 103*; Matope, Cuyuni River, July 23, 1924, *Graham 331*; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2478*.

Range: Widely distributed in tropical America.

Species of **Siderodendron** (or *Tecoma* and *Tabebuia* of the Bignoniaceæ, q.v.) are timber trees of British Guiana known as Hackia or Ironwood, according to Zon and Sparhawk (1923).

117. CUCURBITACEÆ. Gourd Family

Plants delicate climbers; anther cells flexuose or conduplicate... 1. **MOMORDICA**

Plants coarse, woody climbers; anther cells straight or slightly curved, not flexuose.
2. **GURANIA**

I. MOMORDICA Linnæus

- 1.
- Momordica Charantia**
- Linnæus, Species Plantarum 1009. 1753.

WILD BALSAM APPLE

A slender, herbaceous vine with simple, filiform tendrils opposite the leaves; leaves thin, reniform in outline, 5-7 lobed, 4-12 cm. broad, pubescent or glabrate; flowers small, yellow; fruit (pepo) fleshy, yellow, ovoid, 2-12 cm. long, tuberculate, splitting into three valves.

The seeds are surrounded by a red pulp, which is sometimes eaten raw by children and sometimes cooked. In some places a tea made from the leaves is used as an emetic and as a remedy for fever.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1870.

Range: Southern United States, the tropics and subtropics of both hemispheres; probably introduced to America from the old world.

2. GURANIA Cogniaux

Calyx lobes ovate-aculeate; leaves only slightly 3-lobed.....1. *G. Durandii*
Calyx lobes linear; leaves deeply 3-lobed.....2. *G. spinulosa*

- 1.
- Gurania Durandii**
- Cogniaux, Bulletin de la Société Royale de Botanique de Belgique 17: 293. 1878.

A coarse, woody vine; leaves alternate, rough, cordate at the base, acuminate at the apex, tomentose below, up to 20 cm. broad and about as long, slightly lobed, the margin spiny; flowers pediceled, on axillary peduncles exceeding the leaves, and in dense clusters, the sepals orange-red, the petals yellow; fruit oblong, somewhat spindle-shaped, 5 cm. long.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 390; between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1618.

Range: Guianas.

- 2.
- Gurania spinulosa**
- (Pœppig and Endlicher) Cogniaux, Diagnoses de Cucurbitacées Nouvelles 1: 17. 1876.

Anguria spinulosa Pœppig and Endlicher, Nova Genera et Species Plantarum Chilensium 2: 52. pl. 170. 1838.

A woody vine; leaves alternate, pubescent below, deeply 3-lobed, cordate at the base, the lobes cuspidate at the apex, the margin spiny; flowers short pediceled, on axillary peduncles exceeding the leaves; fruit oblong, somewhat spindle-shaped, 6-7 cm. long.

Along Camaria road, Cuyuni River, July 30, 1924, *Graham* 388.
Range: Brazil, Ecuador, and the Guianas.

Lagenaria spp. have gourd-like fruits which are used as utensils and are known as Calabash, although the true Calabash is *Crescentia*, q.v.

118. LOBELIACEÆ. Lobelia Family

1. CENTROPOGON Presl

1. **Centropogon cornutus** (Linnæus) Druce, Botanical Exchange Club of the British Isles 3: 416. 1914.

Lobelia cornuta Linnæus, Species plantarum 930. 1753.

A large, nearly glabrous, succulent herb; leaves alternate, thin, short-petiolate, ovate-elliptic to lanceolate, minutely serrate, acuminate at the apex; flowers long-pedicelod, with a 2-lipped corolla, rose or pale red, 4-5 cm. long, curved, the stamens exserted; fruit a spherical berry, 15 mm. in diameter.

Vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1861.

Range: South America.

119. COMPOSITÆ. Composite Family

- a. Leaves all alternate, or sometimes all basal:
 - b. Flowers greenish-white to yellow or orange:
 - c. Heads about 1.5 cm. high; principal phyllaries in a single series with a few short ones at the base. 1. *ERECHTITES*
 - cc. Heads much less than 1 cm. high; phyllaries all equal or nearly so. 2. *ERIGERON*
 - bb. Flowers white, pink, purple, red or bronze:
 - c. Phyllaries equal, in a single series. 3. *EMILIA*
 - cc. Phyllaries unequal, in 2 or more series. 4. *ELEPHANTOPUS*
- aa. Leaves, except sometimes the uppermost, opposite:
 - b. Pappus of numerous bristles, of plumose bristle-like scales, or of 5 awned scales:
 - c. Plants upright herbs:
 - d. Leaves distinctly crenate, triangular-ovate, nearly as broad as long; pappus of 5 awned scales. 5. *AGERATUM*
 - dd. Leaves irregularly notched, elliptic-ovate, not more than half as broad as long; pappus short, of strap-like scales. 6. *GEISSOPAPPUS*
 - cc. Plants coarse, more or less woody climbers. 7. *MIKANIA*
 - bb. Pappus none or a low crown, of 1-4 awns or short bristles, or of scales without awns:
 - c. Plants woody shrubs:
 - d. Flowers white. 8. *CLIBADIUM*

9. *WULFFIA*
- cc. Plants herbaceous, but sometimes very large:
- d. Leaves pinnately several-lobed, or once or twice pinnatisect.
10. *COSMOS*
- dd. Leaves merely toothed, or entire, or palmately 3-lobate.
11. *WEDELIA*

1. ERECHTITES Rafinesque

1. **Erechtites hieracifolia** (Linnaeus) Rafinesque, in DeCandolle, Pro-
dromus Systematis Naturalis Regni Vegetabilis 6: 294. 1837.

Senecio hieracifolius Linnæus, Species Plantarum 866. 1753.

An erect, nearly glabrous annual; leaves alternate, mostly lanceolate, coarsely toothed, the upper sessile, the lower tapering to short petioles; flowers greenish-white to yellow; heads 1.5 cm. high, in small corymbs; involucre a single series of linear, erect phyllaries with a few much shorter ones at the base; the 10-striate achenes have a pappus of numerous soft, white bristles.

Matope, Cuyuni River, July 23, 1924, *Graham* 340.

Range: West Indies and continental temperate and tropical America.

2. ERIGERON Linnæus

1. *Erigeron bonariensis* Linnæus, Species Plantarum 863. 1753.

Leptilon bonariense Small, Flora of the Southeastern United States 1231, 1340.
1903.

A coarse, weedy, somewhat hairy annual; leaves alternate, sessile or on margined petioles, the lower often 15 cm. long, 2 cm. broad, toothed or pinnately lobed, the upper smaller, linear to lanceolate, entire; heads small, 4-5 mm. high, loosely paniced, the ray flowers with small and inconspicuous rays, the involucre of numerous linear, slightly unequal phyllaries; achenes compressed, with a pappus of slender, tawny bristles.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham 150*; vicinity of Wismar, Demerara River, Lat. 6° N., October 12-16, 1922, *De La Cruz 2445*.

Range: Common weed in Florida, West Indies and tropical continental America.

3. EMILIA Cassini

Phyllaries shorter than the flowers; involucre 4-6 mm. thick; flowers red to scarlet or crimson; stem leaves irregularly toothed, rarely lyrate-lobed. . . 1. *E. coccinea*

Phyllaries equalling the flowers; involucre about 3 mm. thick; flowers rose to purple or white; stem leaves usually lyrate-lobed. 2. *E. sonchifolia*

1. **Emilia coccinea** (Sims) Sweet, Hortus Britannicus, ed. 3. 382. 1839.

Cacalia coccinea Sims, Botanical Magazine pl. 564. 1802.

An annual, nearly glabrous herb 2-7 dm. high, erect; leaves alternate, the basal and lower variously dentate, ovate to suborbicular, often with margined petioles, up to 12 cm. in length, the upper sagittate-clasping, dentate or entire; heads few to several, the involucre 7-13 mm. high by 4-6 mm. thick; flowers red, scarlet, or crimson, exceeding the phyllaries which are oblong-acuminate and in a single row; achene short, slender, 5-angled, with a pappus of numerous, soft, white bristles.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 223.

Range: Florida, West Indies, Panama, northern South America and the Pacific Islands.

2. **Emilia sonchifolia** (Linnæus) DeCandolle, Prodrromus Systematis Naturalis Regni Vegetabilis 6: 302. 1837.

Cacalia sonchifolia Linnæus, Species Plantarum 835. 1753.

An annual, nearly glabrous herb 2-7 dm. high; leaves alternate, the lower petioled, obovate to oblanceolate, repand-dentate to lyrate-pinnatifid, obtuse or acute at the apex, the upper ones sessile, sagittate-clasping, dentate-lobed or entire; heads mostly corymbose, the involucre 8-12 mm. high by 3 mm. thick; flowers rose, purple, violet or sometimes white; involucre 8-12 mm. high, about 3 mm. thick; achene 5-angled, with a pappus of soft, white bristles.

Matope, Cuyuni River, July 23, 1924, *Graham* 328; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3008.

Range: Florida, West Indies, continental tropical America, and the tropics of the old world; a common weed.

4. ELEPHANTOPUS Linnæus

1. **Elephantopus mollis** Humboldt, Bonpland, and Kunth, Nova Genera et Species Plantarum 4: 26. 1820.

An erect, hairy herb 2-10 dm. high; leaves alternate, the lower oblong to obovate, crenate, roughish above, soft-pubescent beneath, the upper much smaller, ovate to lanceolate, acute, entire; flowers white to red or purple, the heads small, narrow, with 5 or fewer flowers, arranged in a globose, bracted head 1-2 cm. in diameter, the heads mostly terminal; achene 10-ribbed, pubescent, the pappus of few bristles which are dilated at the base.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 395; Malali, Demerara River, Lat. about 5° 35' N., October 30-November 5,

1922, *De La Cruz* 2620; Pomeroon River, Pomeroon District, June 14-20, 1923, *De La Cruz* 2921.

Range: Cuba and Lower California to South America; throughout the tropics generally.

5. AGERATUM Linnæus

1. *Ageratum conyzoides* Linnæus, Species Plantarum 839. 1753.

A villous, erect annual 9 dm. high or less; leaves opposite, petioled, ovate or deltoid, obtuse at the apex, subcordate at the base, crenate, 2-8 cm. long; flowers white or lavender, in diskoid heads, about 5 mm. long, arranged in small corymbs, the phyllaries thin, ribbed, subequal, in 2 or 3 series; achenes 5-angled, with a pappus of 5 awned scales.

Matope, Cuyuni River, July 23, 1924, *Graham* 333; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3039.

Range: A weed in the tropical and subtropical regions of both hemispheres.

6. GEISSOPAPPUS Benthams

1. *Geissopappus caleoides* (DeCandolle) Benthams, in Hooker, Journal of Botany 2: 44. 1840.

Schomburgkia caleoides DeCandolle, Prodromus Systematis Naturalis Regni Vegetabilis 7: 294. 1838.

A slender pubescent herb; leaves opposite, rough-pubescent, short-petioled, ovate-crenate, 2-4 cm. long; flowers small, in slender peduncled heads 5 mm. long, the phyllaries oblong-ovate, membranous, imbricated; achene pubescent, round or 2-4-angled, the pappus short, of strap-like scales.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 146.

Range: Guianas, Venezuela and Brazil.

7. MIKANIA Willdenow

Leaves cordate:

Heads compactly grouped in dense corymbs.....1. *M. Parkeriana*

Heads loosely grouped.....2. *M. micrantha*

Leaves not cordate:

Inflorescence corymbiform; involucre 6 mm. high; pappus 7 mm. long.

3. *M. trinilaria*

Inflorescence paniculate; involucre 5 mm. high; pappus 4 mm. long.

4. *M. scabra*

1. **Mikania Parkeriana** DeCandolle, *Prodromus Systematis Naturalis Regni Vegetabilis* 5: 199. 1836.

Eupatorium scandens Linnæus, *Species Plantarum* 836. 1753.

Mikania scandens Willdenow, *Species Plantarum* 3: 1743. 1804.

Willoughbya scandens O. Kuntze, *Revisio Generum Plantarum* 1: 371. 1891.

A climber, glabrous or nearly so; leaves opposite, ovate or hastate, deeply cordate at the base with the lobes rounded or truncate, acuminate at the apex, repand or obtusely dentate, 6-10 cm. long, 4-6 cm. broad, petioles slender, shorter than the blades; heads in compact, cymose clusters borne at the ends of the branches, the involucre 5 mm. high, the bracts lanceolate or acuminate; flowers white or pink; achene resinous, 5-angled, pappus of slender, rough bristles.

Several species of *Mikania*, known as "Guaco," are used in Central America as remedies for snake bite.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 3048.

Range: Eastern North America south of Maine, South America and the tropics generally.

2. **Mikania micrantha** Humboldt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 4: 134. 1820.

Willoughbya micrantha Rusby, *Memoirs of the Torrey Botanical Club* 4: 211. 1895.

Mikania scandens Millspaugh, *Field Museum of Natural History, Botanical Series* 1: 324. 1896; not *M. scandens* Willdenow 1804.

Willoughbya scandens Millspaugh and Chase, *Field Museum of Natural History, Botanical Series* 3: 96. 1904; not *W. scandens* Kuntze 1891.

A nearly glabrous, herbaceous vine; leaves opposite, hastate-cordate, repand-dentate, 6-10 cm. long, 3-5 cm. broad; flowers white, with the odor of vanilla, the heads 5-7 mm. high; achene 5-angled, pappus of slender, rough bristles.

This species is similar to the preceding but the flower clusters are looser and the vine is more clambering in habit. *Graham* 131 and *Graham* 231 were both collected climbing over clearing second growth.

Kalacoon, vicinity of Kartabo, June 29, 1924, *Graham* 131; Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 231; vicinity of Bartica, Essequibo River, Lat. 6° 25' N., September 3-12, 1922, *De La Cruz* 1941; Pomeroon River, Pomeroon District, January 14-20 1923, *De La Cruz* 2968.

Range: Common and variable in form, from Canada to Argentine.

3. *Mikania trinitaria* DeCandolle, Prodrumus Systematis Naturalis Regni Vegetabilis 5: 194. 1836.

Eupatorium trinitarium Gómez, Anales de la Sociedad Española de Historia Natural 19: 270. 1890.

Willoughbya trinitaria O. Kuntze, Revisio Generum Plantarum 1: 373. 1891.

A coarse, finely pubescent vine; leaves opposite, abrupt at the base, ovate to elliptic, acuminate at the apex, entire or coarsely serrate, 6-15 cm. long, 3-6 cm. broad; flowers in large, compound, cymose clusters, the heads 10-15 mm. high, the phyllaries oblong-linear; achene 5-angled, the pappus bristly, tawny, exceeding the achene in length.

Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2976.

Range: Trinidad and the Guianas.

4. *Mikania scabra* DeCandolle, Prodrumus Systematis Naturalis Regni Vegetabilis 5: 190. 1836.

Willoughbya scabra O. Kuntze, Revisio Generum Plantarum 1: 372. 1891.

A pubescent vine; leaves opposite, ovate-elliptic, tapering at both ends, obtuse at the base, very scabrous, entire or serrate, 6-15 cm. long, 3-6 cm. broad; flowers in compound, spike-like racemes, the heads 5 mm. high, phyllaries oblong, equalling the flowers; achenes 5-angled, the pappus tawny bristly, equalling the achene in length.

Between the Demerara and Berbice Rivers, Lat. about 5° 50' N., July 15-19, 1922, *De La Cruz* 1568.

Range: Peru and the Guianas.

8. CLIBADIUM Linnæus

1. *Clibadium sylvestre* (Aublet) Baillon, Histoire des Plantes 8: 307. 1886.

Baillieria sylvestris Aublet, Histoire des Plantes de la Guiane Française 2: 807. 1775.

An erect shrub 1-2.5 m. high; leaves opposite, constricted and decurrent at the base, ovate-oblong, petioled, crenate, and densely rough pubescent, 15 cm. long or more; heads white, subglobose, small, 5 mm. high, and arranged in flat-topped, terminal corymbs; involucre of a few, broad, rounded, thin, closely imbricated phyllaries, the outer flowers fertile, the inner sterile; achenes rounded, obovoid, compressed, without a pappus.

According to Howes (1930) this species is one of those plants known only from native habitations. It is cultivated for its value as a fish poison plant. The leaves are used, mixed with bait, and the seeds may be used also, it is believed.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1972.

Range: South America.

9. WULFFIA Necker

1. **Wulffia baccata** (Linnæus filius) O. Kuntze, *Revisio Generum Plantarum* 1: 373. 1891.

Coreopsis baccata Linnæus filius, *Supplementum Plantarum* 380. 1781.

An arching shrub; leaves opposite, short-petioled, ovate to oblong-ovate, crenate or nearly entire, rough, 10-15 cm. long, 4-6 cm. broad; flowers red or yellow, in heads about 2 cm. broad, with small rays, the involucre of 2-3 series of subequal, green bracts; achene 4-angled, or compressed, with no pappus, the fruit at maturity fleshy.

Kyk-over-al, vicinity of Kartabo, July 9, 1924, *Graham* 225; vicinity of Kartabo, July 18, 1924, *Graham* 279; along Camaria road, Cuyuni River, July 31, 1924, *Graham* 390a; between the Demerara and Berbice Rivers, Lat. about $5^{\circ} 50' N.$, July 15-19, 1922, *De La Cruz* 1570; vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1983.

Range: Central America and northern South America.

10. COSMOS Cavenilles

1. **Cosmos caudatus** Humboldt, Bonpland, and Kunth, *Nova Genera et Species Plantarum* 4: 240. 1820. MARGARITA

A tall, branched perennial, 2 m. high or less, nearly glabrous; leaves opposite, bipinnate, the lower 15 cm. long; heads 12-15 mm. high, long-stalked, the involucre biseriate, the rays rose-purple; achenes linear-spindle-shaped, the pappus of 2 slender, deflexed awns 2-3 mm. long.

Vicinity of Bartica, Essequibo River, Lat. $6^{\circ} 25' N.$, September 3-12, 1922, *De La Cruz* 1862; Pomeroon River, Pomeroon District, January 14-20, 1923, *De La Cruz* 2932.

Range: Florida, West Indies and continental tropical America.

II. WEDELIA Jacquin

1. **Wedelia trilobata** (Linnæus) A. S. Hitchcock, Report of the Missouri Botanical Garden 4: 99. 1893.

Silphium trilobatum Linnæus, Systema Naturæ, ed. 10. 1233. 1759.

*Wedelia carnos*a L. C. Richard, in Persoon, Synopsis Plantarum seu Enchiridium Botanicum 2: 490. 1807, excluding synonyms.

Stemmodontia trilobata Small, Flora of the Southeastern United States 1262, 1340. 1903.

A procumbent herb; leaves opposite, rather fleshy, elliptic to obovate, dentate or lobate, 2-12 cm. long, 2-3 cm. broad, tapering to a nearly sessile base, obtuse or acute at the apex; peduncles solitary in the upper leaf axils, 2-14 cm. long, the involucre 8-12 mm. high, the phyllaries biseriate, the outer large, ovate-oblong, green and foliaceous, the notched, yellow rays showy; achenes oblong, tuberculate, conic at the apex, 5 mm. long.

Along Camaria road, Cuyuni River, July 31, 1924, *Graham* 401.

Range: Widely distributed from the Bahamas and Florida throughout the West Indies, and from Honduras to Colombia.

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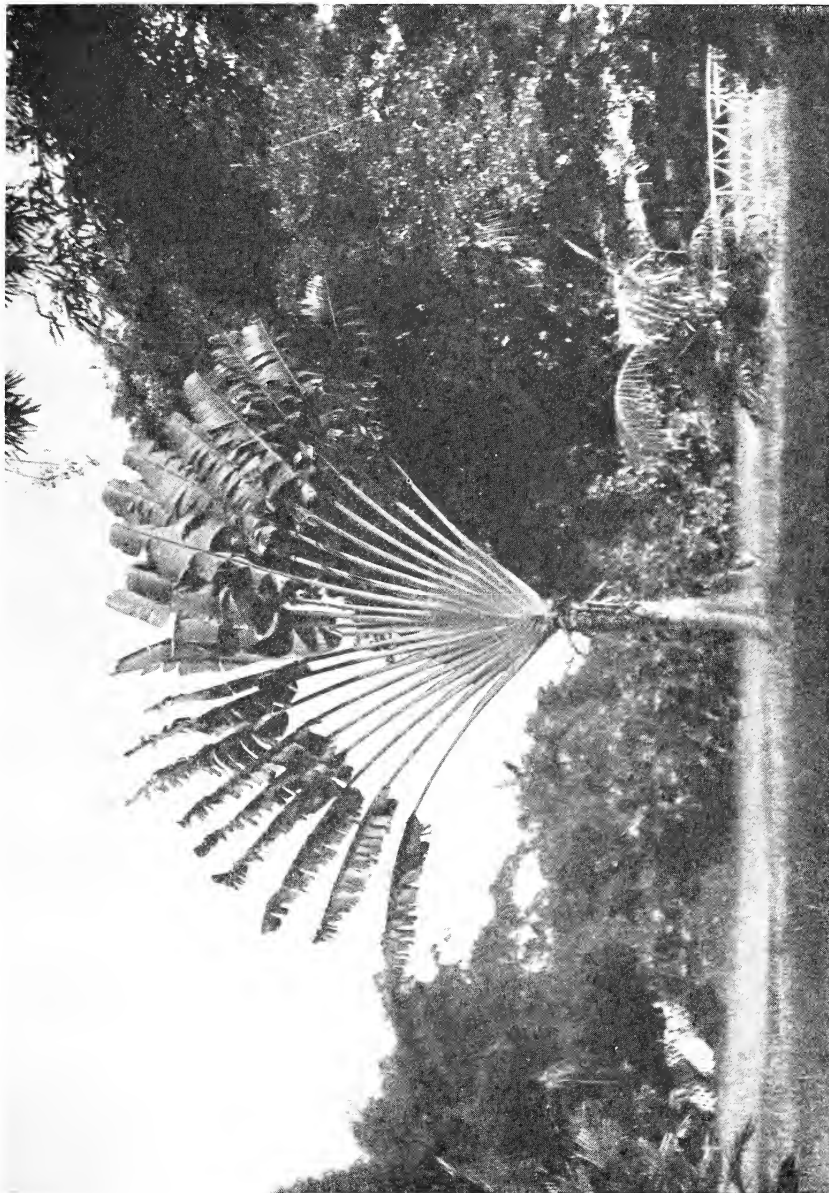
ZOOLOGICA.

See various numbers since 1916 on the natural history of the New York Zoological Tropical Research Station at Kartabo, British Guiana.

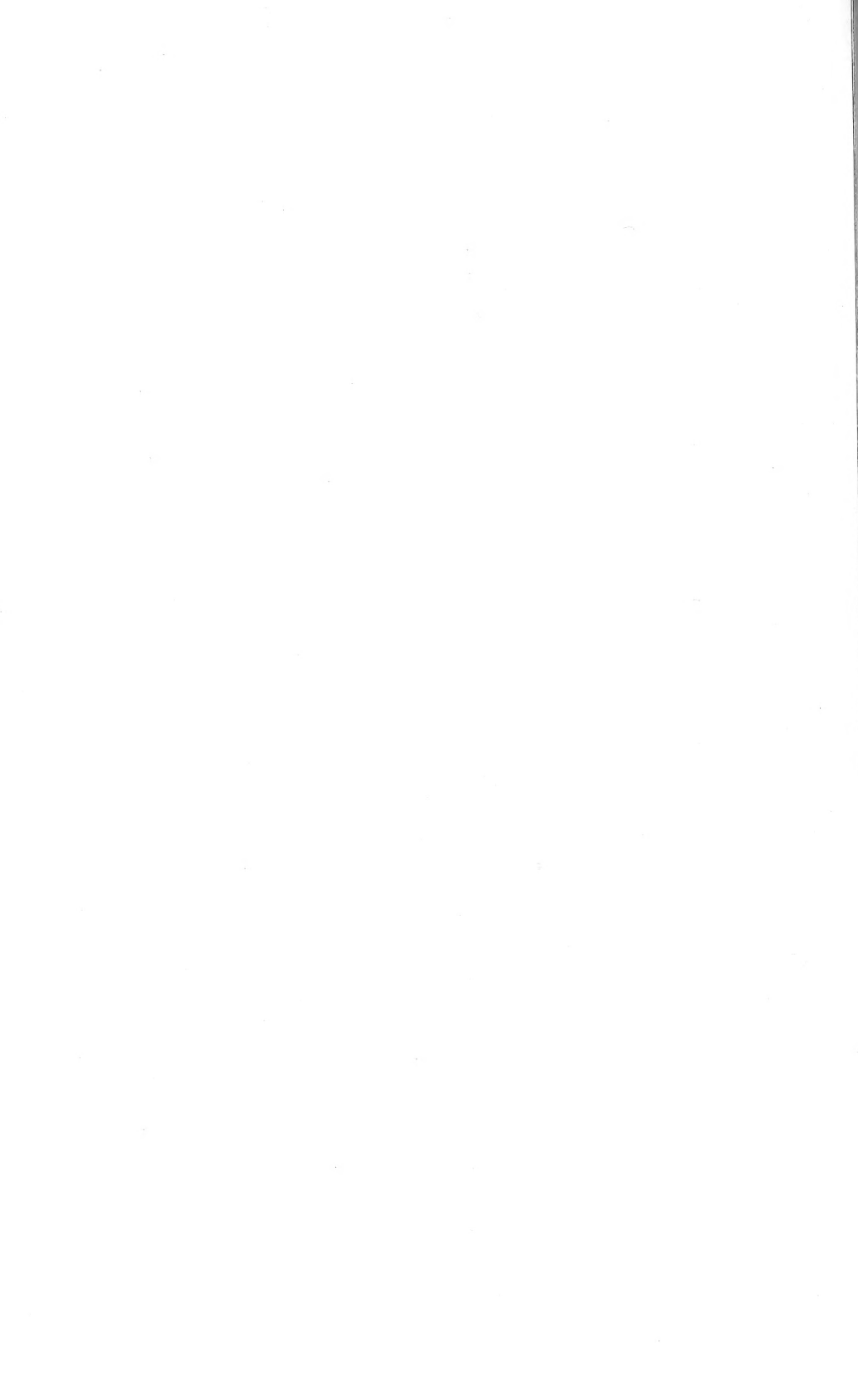


Victoria regia as it appears in the Georgetown Botanic Garden. It is native to the Kartabo region and was originally described from the Denerara River. Photo furnished by Hugh M. Raup.





The Traveler's Tree, *Ravenala madagascariensis*, in the Georgetown Botanic Garden. *R. guyanensis*, native to the Kartabo region, differs from its Madagascar relative in having its leaves as long as, instead of shorter than, the petioles. Photo furnished by Hugh M. Raup.





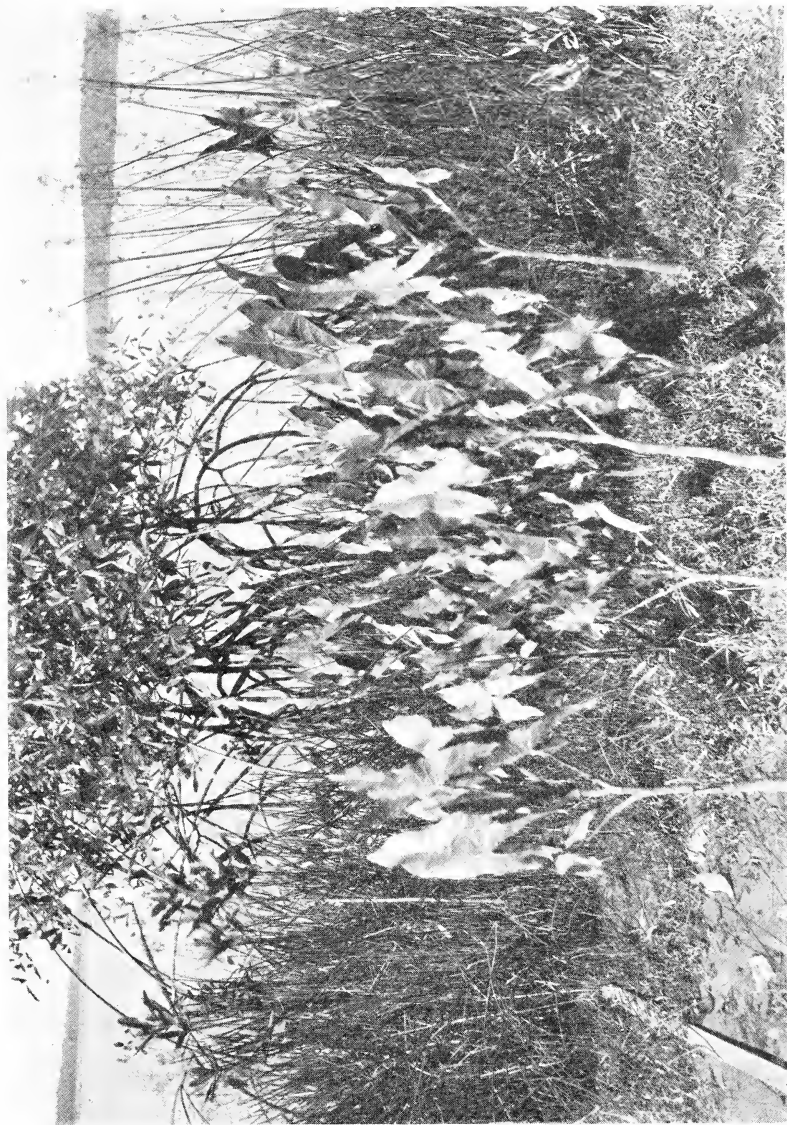
The Laboratory at Kartabo, surrounded by cultivated Bamboos, *Bambusa vulgaris*, which thrive well in the region.
The Cuyuni River is in the foreground. Photo furnished by Hugh M. Raup.





View from the Laboratory compound showing expanse of jungle across the Cuyuni River. Here the Cuyuni is joined by the Mazaruni River which flows into the Essequibo in the middle distance. The overhanging branches are those of the cultivated Bamboo. Photo furnished by Wm. Beebe.





Fluvio-Littoral Association showing Mangrove, *Rhizophora Mangle*, with stilt roots, in the background, and the Mucka-Mucka, *Montrichardia arborescens*, with broad sagittate leaves, in the foreground. Between them is a Sedge, *Cyperus difflusus*. Photo furnished by Wm. Beebe.





High-Forest Society along a jungle road showing tall trees of the forest and characteristic abundance of lianas. Photo furnished by Wm. Beebe.





Base of *Mora*, *Mora excelsa*, showing typical buttressed trunk.

Photo furnished by Hugh M. Raup.



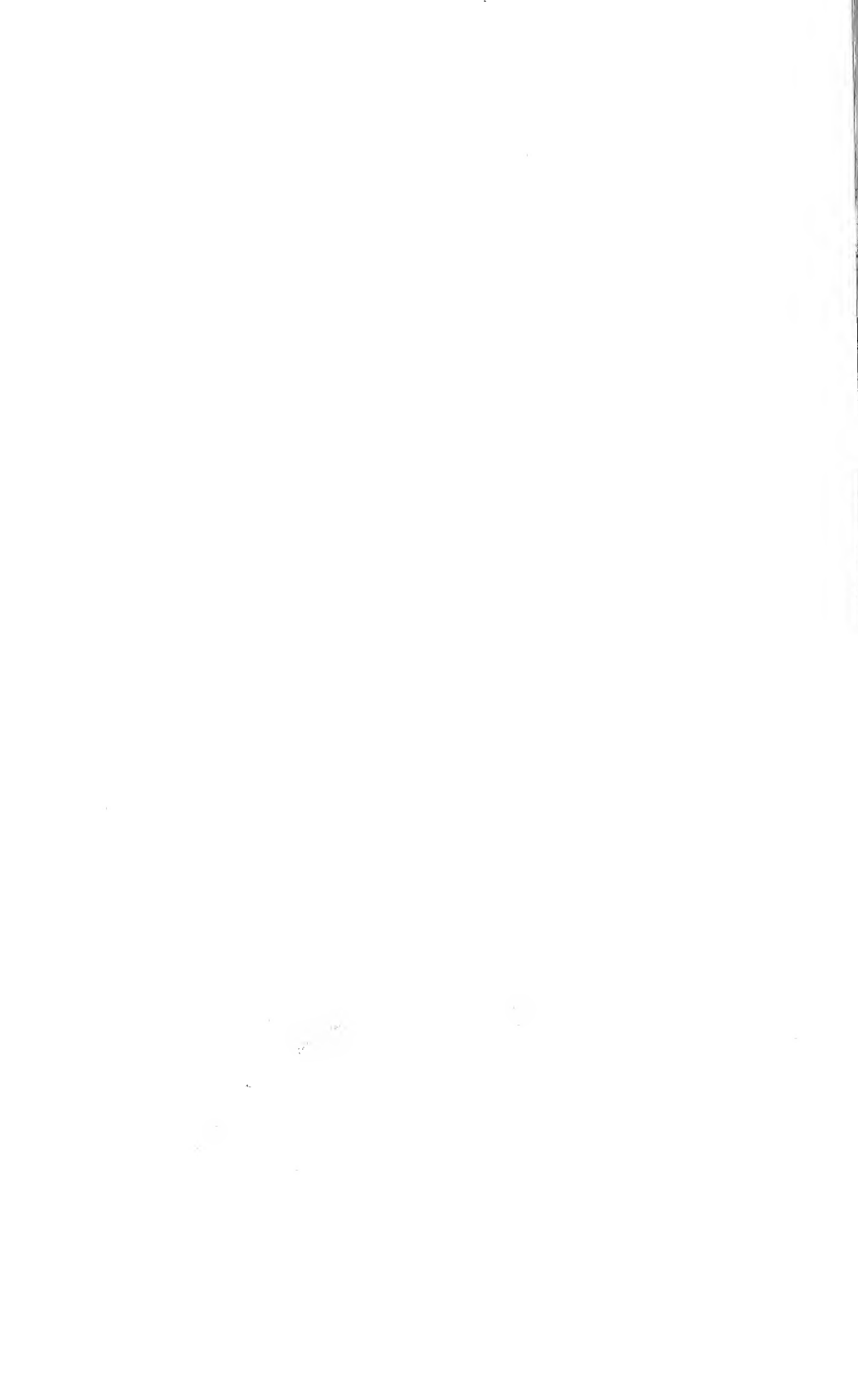


Jungle showing characteristic vegetation of the Mid-Forest and Low-Forest Societies. Photo furnished by Wm. Beebe.



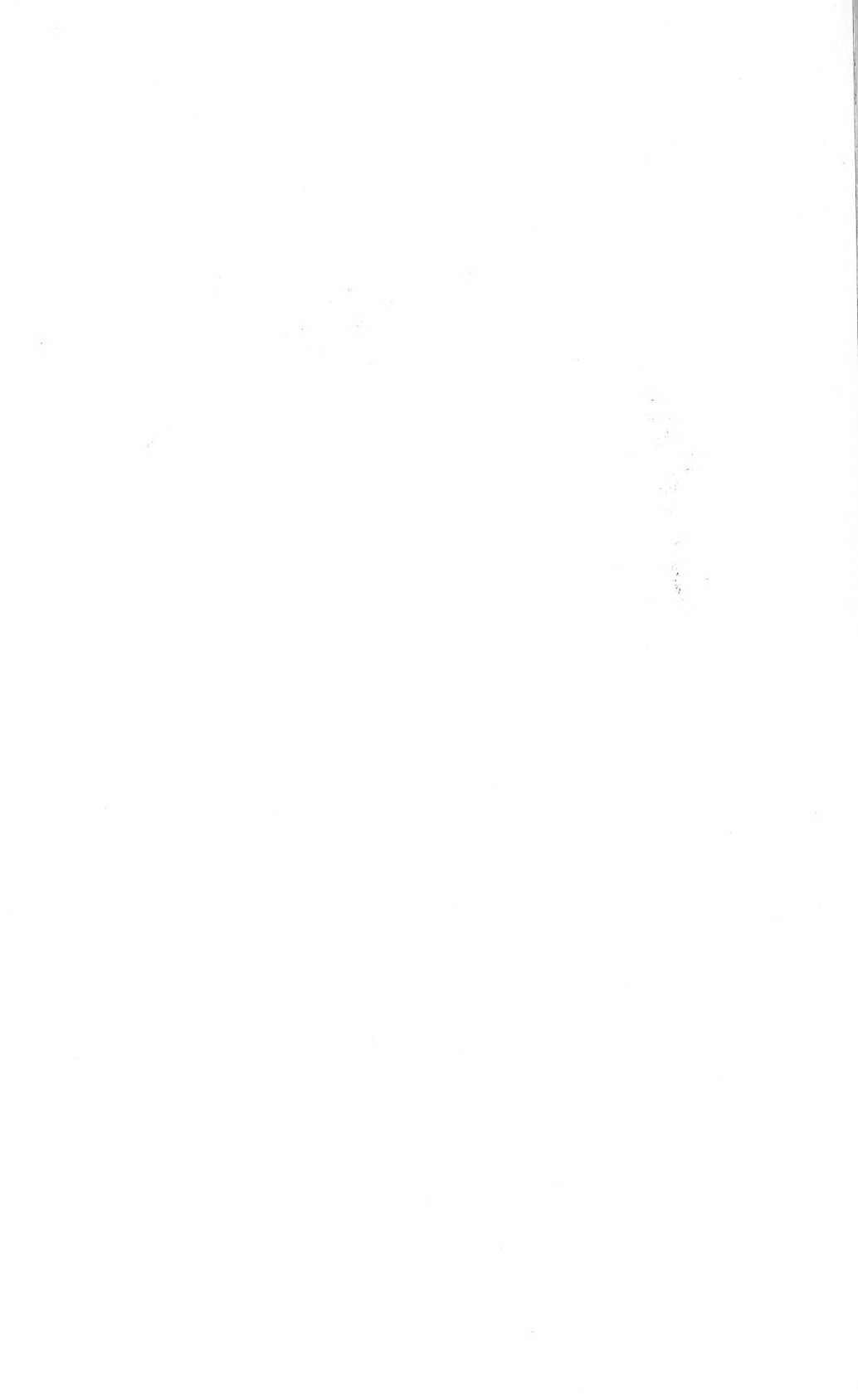


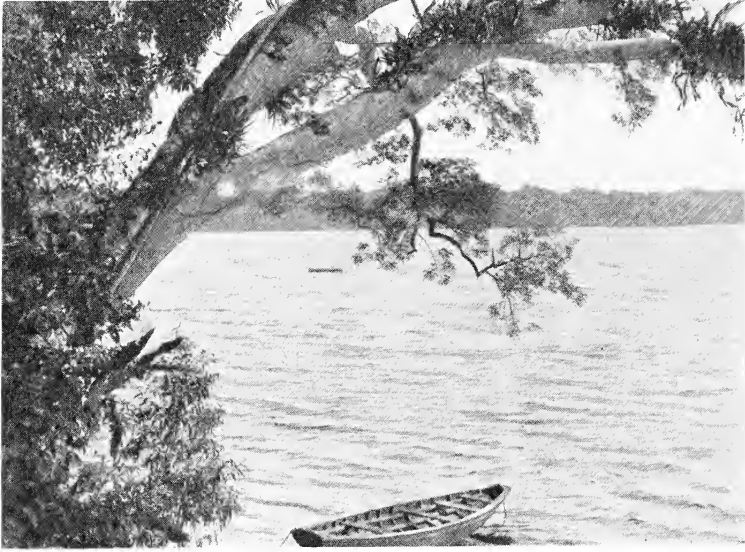
Palm swamp, forming part of the Low-Forest Society. The palms occur in limited numbers in particularly moist areas of the jungle, and like the Crabwood, Mora, Greenheart, and Wallaba, are the only trees of the jungle which tend to produce pure stands. Photo furnished by Wm. Beebe.





Forest-Floor Society, showing general absence of small herbaceous forms. Some lianas, ferns, and marantaceous plants are in evidence. Photo furnished by Hugh M. Raup.



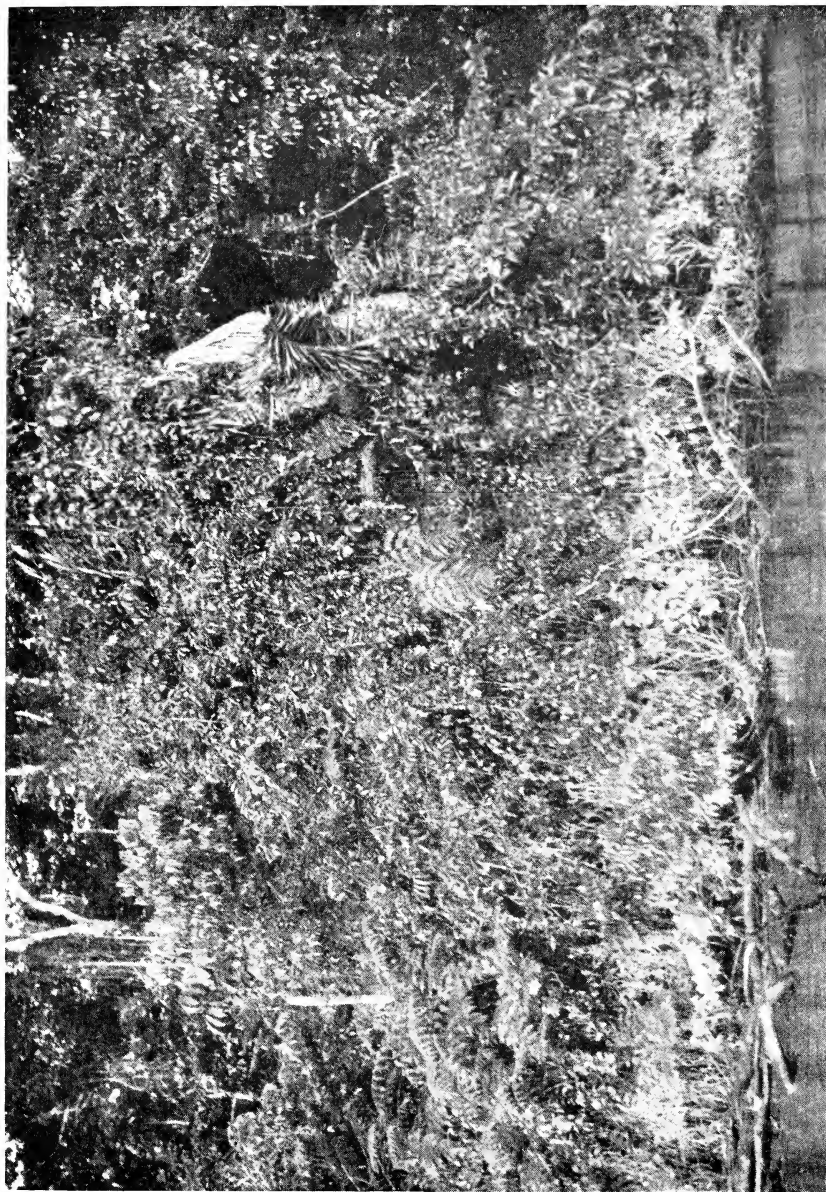


Epiphytic orchids and ferns on a tree overhanging the Cuyuni River at Kartabo, illustrating the Epiphyte Society. Photo furnished by J. K. Doult.



Jungle along the Essequibo River near Kartabo showing trees of the High-Forest Society and plants of the Forest-Margin Society which form characteristic curtains of vines that hang from the trees and drape into the water below. Photo furnished by Hugh M. Raup.



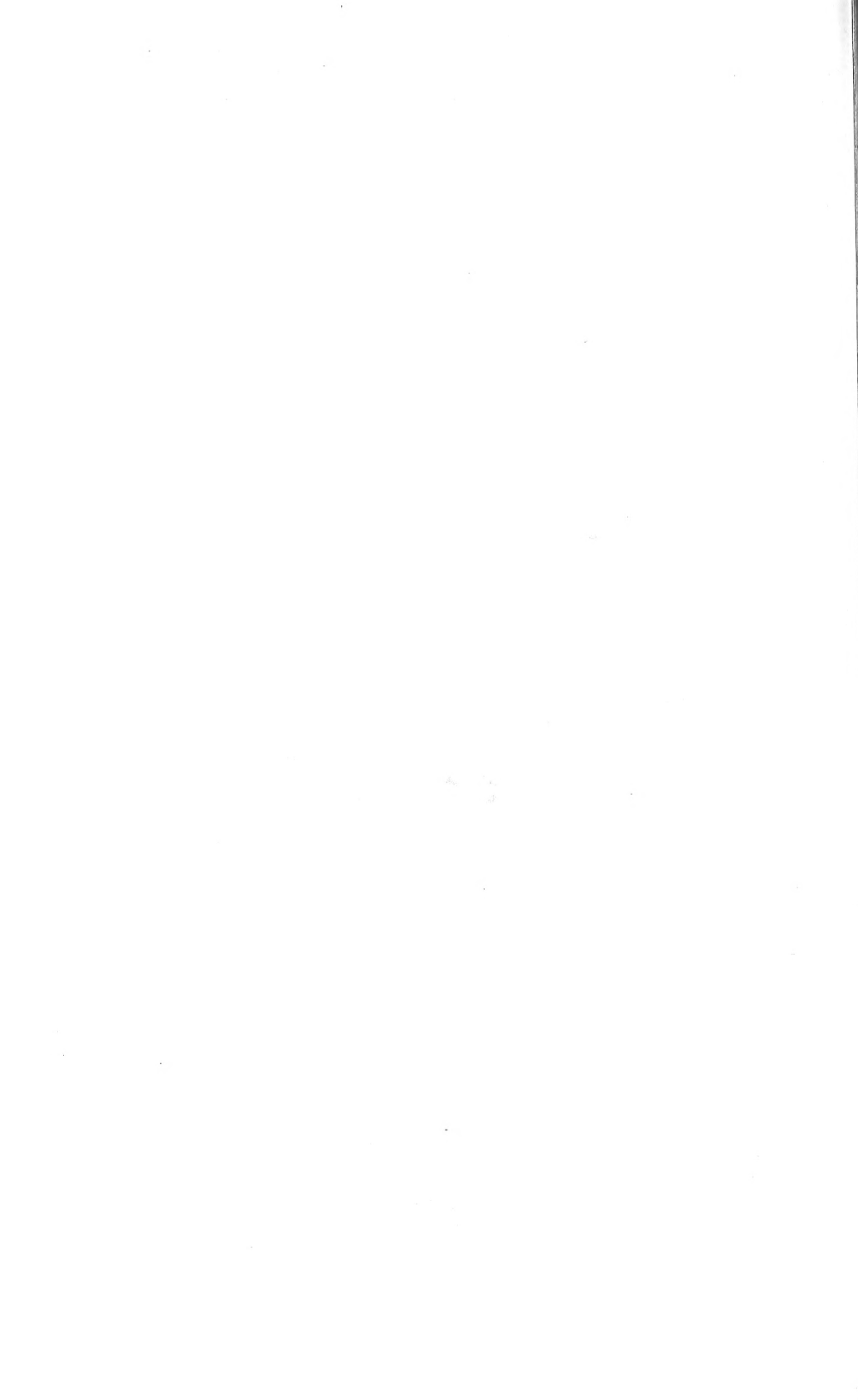


Close-up of Forest-Margin Society along the river's edge. The flowers and elliptic leaves of the common vining *Allamanda cathartica* and the fronds of a Tree Fern, *Alsophila microdonta*, are conspicuous. Photo furnished by Hugh M. Raup.



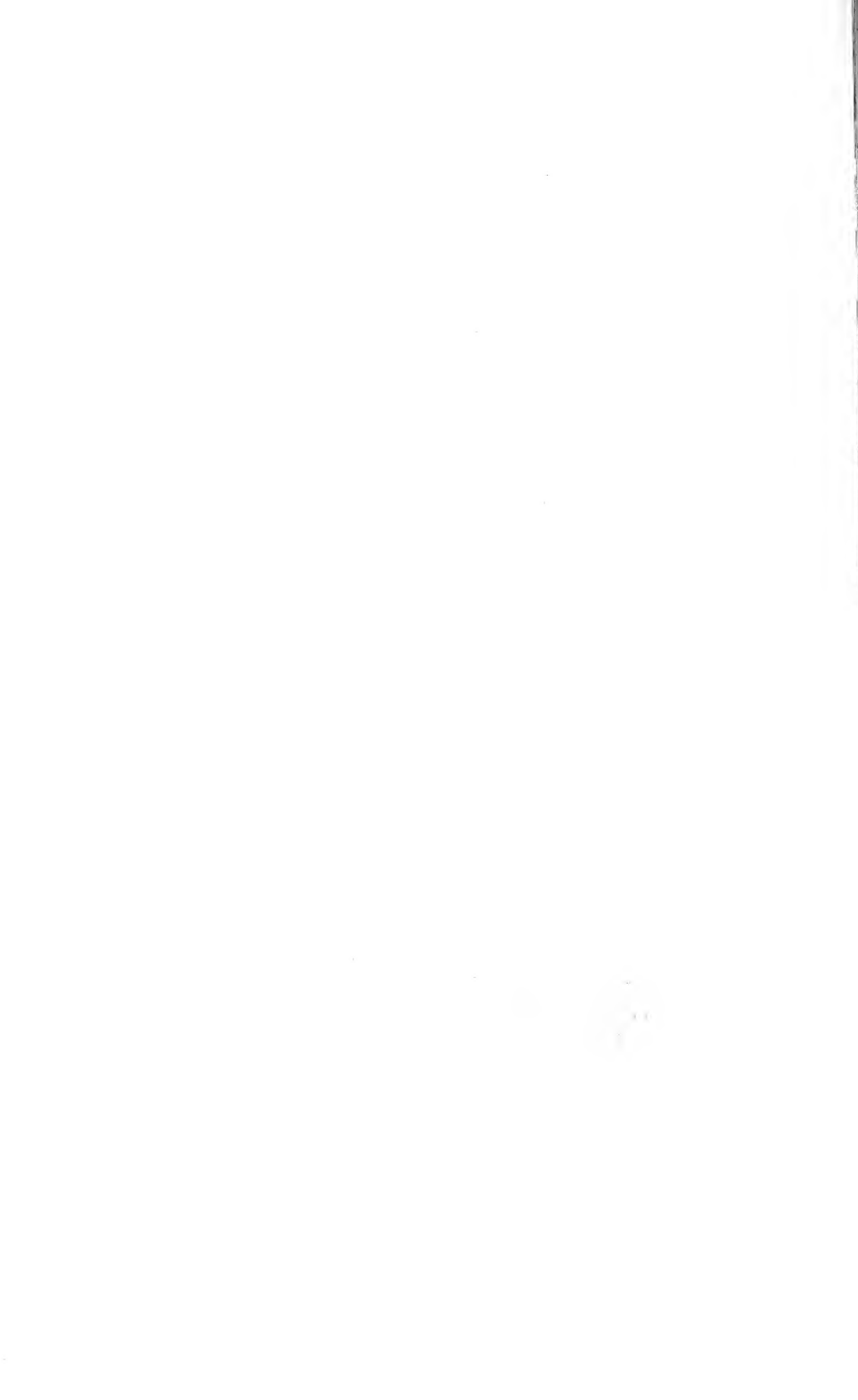


Compound at Kartabo showing cultivated Bamboo at the left and typical shrubs and herbaceous forms of the Forest-Clearing Associates in the middle distance. Photo furnished by Wm. Beebe.



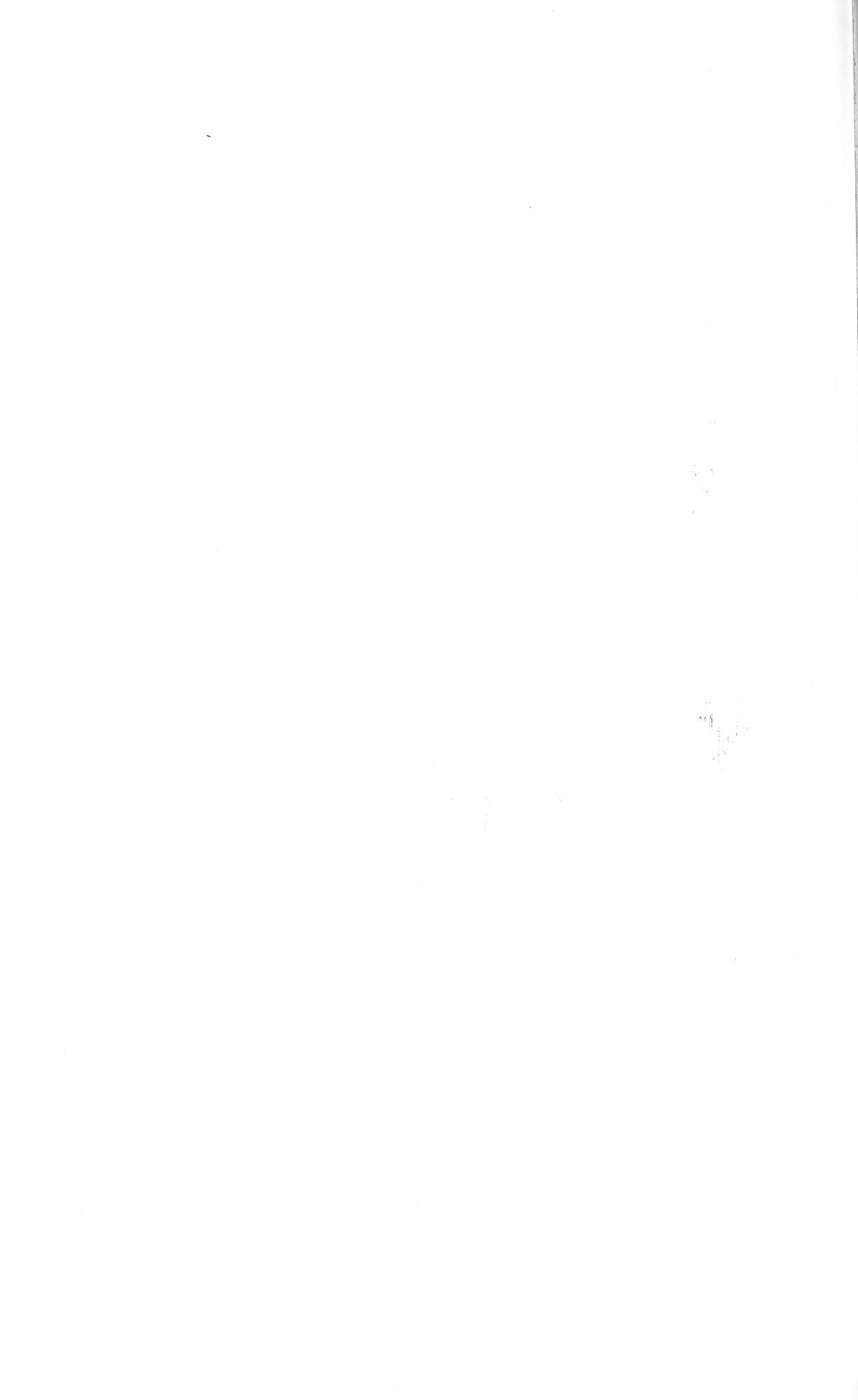


Camaria road, showing herbaceous plants of the Forest-Clearing Associates on the roadway and shrubs of the same community at the road's edge, with several giants of the High-Forest Society in the background. Photo furnished by Hugh M. Raup.





Well developed Forest-Clearing Associates or second growth jungle with a Strangling Fig, *Clusia* sp., enveloping a palm. Photo furnished by Hugh M. Raup.



ANNALS
OF THE
CARNEGIE MUSEUM
VOLUME XXII, NOS. 2-4



III. NOTES ON THE FOSSIL LAND SHELLS FROM BERMUDA IN THE COLLECTION OF THE CARNEGIE MUSEUM

BY GORDON MACMILLAN KUTCHKA

FOREWORD.

A small collection of land shells from Bermuda was assigned to the author by Dr. Stanley T. Brooks, Curator of Recent Invertebrates, and was studied under the guidance of Dr. I. P. Tolmachoff, Curator of Invertebrate Paleontology.

These shells were removed from three pieces of matrix collected in 1928 by Dr. George H. Clapp and Dr. A. Avinoff at the Government Quarry, near Harrington House, Hamilton Parish, Bermuda. The largest of these pieces is shown on Plate XIX.

The author began the work of clearing the specimens from these matrices on the assumption that they were recent shells imbedded in travertine. But, as the work progressed and the forms were identified, it became evident that they were fossil land shells of the Pliocene Series of the Upper Tertiary Period. They were imbedded in a compact and hard æolian limestone, so weather-worn and infiltrated, that the sandstone drifts were indistinguishable.

It is evident that the vegetation, at the habitat of these shells during the Pliocene, was luxuriant, as is indicated by the great number of shells which were massed together at the place of their deposition. They were so closely compressed that two or three, or even four shells had to be sacrificed in the course of the clearing in order to obtain one perfect specimen.

Of all the shells extracted from these three pieces of æolian limestone, *Pacilozonites blandi heilprini* Pilsbry, *P. reiniauuus antiquus* Verrill, and *P. bermudensis zonatus* Verrill comprised the largest number, while *Succinea somerseusis* Verrill constituted the least.

It was considered appropriate to devote a portion of this paper to the geology and other characteristics of the Bermuda Islands before proceeding with the description of the shells.

SUMMARY OF THE GEOLOGIC HISTORY OF BERMUDA.

The Bermudas are a small group of low oceanic islands formed of coral and wind-blown coral sand consolidated into rock. They are situated about 700 miles from North Carolina, and are thus rather favorably placed for receiving immigrants from the American mainland and its islands. According to A. R. Wallace: "The discovery of a layer of earth with remains of cedar trees forty-eight feet below the present high-water mark shows that the islands were once more extensive, and probably included the whole area now occupied by the shoals and reefs."* At the present time the total area of the numerous islands does not exceed fifty square miles. These islands most likely represent the remains of the higher land areas of the so-called Caribbean Continent of past geological periods.

The indigenous molluscan fauna of Bermuda has undoubtedly been derived from the West Indies. Since the island is typically oceanic there is an indication that the land molluscs of many families, including *Zonitidæ* and *Succineidæ*, may have been transported great distances through the agencies of floating materials, trees, etc., swept from rivers and carried to this group of islands by the Gulf Stream from the West Indies, over a distance of 700 miles.

Nearly all of the rocks are composed of wind-drifted shell sand, with very little material derived from corals and other living organisms, such as foraminifera, bryozoa, corallines, etc. These materials, when consolidated, form a true æolian limestone, sometimes friable, but in some places hard and compact, and even crystalline.

BERMUDA IN THE PLIOCENE

The Walsingham Formation contains several species of extinct land snails, of which the largest and most abundant is *Pæcilonites nelsoni* Bland.

The most prominent characteristic of the rocks is the compact and hard æolian limestone, which has become in many places and over wide areas so highly infiltrated with calcite that the original structure produced by drifting sand has been obscured or lost. For this reason, they sometimes appear to be in thick massive strata. In many places, however, these rocks have remained friable or soft with a well marked original structure, in some cases including layers or pockets of imperfectly consolidated, or loose, shell-sand. Between the layers of lime-

*Wallace, A. R., *Island Life*, p. 249.

stone are successive layers of red clay, a product of decomposition, representing ancient soils. These may be more or less indurated by the infiltration of calcite, which with the shells, sometimes forms a reddish breccia-like mass. The fossil land shells occur in the limestone, either consolidated or friable, but are most abundant in the portions connected with the layers of red clay, especially in, and immediately above, the latter.

It is apparent that the Walsingham Formation was deposited in the Pliocene during a long period of time, on account not only of the great thickness of its limestone strata, but also of the presence of successive layers of red-clay soil, interstratified with them. Each of these layers of soil indicates a long period of decomposition of the surface. This red-clay layer is also characterized by containing many of the fossil forms of the land snail, *Pæcilonites nelsoni*.

The pieces of æolian limestone, from which the present specimens were procured, preserve some traces of this red clay.

The Paget Formation consists chiefly of æolian limestone, unconsolidated shell sand, and layers of red clay. It is correlated with a period of re-elevation of the American coast.

Only two of the fossils reported from this formation are represented in the collection of the Museum. These are *Pæcilonites bermudensis zonatus* and *Succinea somersensis*.

The author is inclined to assign to the Walsingham Formation the specimens of the genus *Pæcilonites* in the collection of the Museum on account of the small number of specimens known to be recorded from the Paget Formation.

These shells, as mentioned before, were collected in the Government Quarry at Hamilton Parish, which is one of the localities ascribed to this formation by A. E. Verrill.

DESCRIPTION OF MATERIAL

FOSSILS OF THE WALSINGHAM FORMATION IN THE COLLECTION OF THE MUSEUM

Family SUCCINEIDÆ.

Succinea somersensis Verrill.

Succinea somersensis Verrill, Trans. Conn. Acad., New Haven, 1904, p. 171.

"This ancient form is distinct from the recent species, *Succinea barbadensis* Gould, by being larger and stouter. It is usually 12 to 13 mm. in height and about 7 mm. in diameter; the length of the last

whorl is about 9 mm. It is regularly ovate. The nearly smooth surface shows delicate lines of growth. The spire is small and acute. The shell is thicker than that of the living form." Verrill.

The measurement of the specimen in the collection of the Museum nearly corresponds to that given by Verrill, the altitude of it being 11 mm., the diameter 6.5 mm., and the altitude of the last whorl 8.5 mm.

Family ZONITIDÆ.

Genus PÆCILOZONITES.

This genus comprises the most interesting group of land snails of the Bermuda Islands. Since it is endemic to these islands and also isolated zoologically, this group has been differentiated into many strikingly diverse species and races.

No forms closely allied to the genus *Pacilozonites* are known from the Antilles or from Europe. Therefore, it appears that the oldest element in the Bermudian fauna of snails is distinctly North American, while all the rest of the endemic fauna is Antillean in character.

"*Pacilozonites* resembles the North American continental genera *Gastrodonta* and *Ventridens* in its complicated reproductive organs, but it differs in the extraordinary character of having no pedal furrow (at least in *Pacilozonites bermudensis* Pfr.), and the genital orifice is submedian on the right side."*

The helicoid species in the collection of the Carnegie Museum which are confined to Bermuda are *Pacilozonites cupula* Gulick, *P. dalli* Gulick, *P. bermudensis zonatus* Verrill, *P. nelsoni* Bland, *P. nelsoni callosus* Gulick, *P. blandi heilprini* Pilsbry, and *P. reinianus antiquus* Verrill.

The considerable divergence existing between the various species of the genus *Pacilozonites* peculiar to Bermuda indicates that the island is of considerable antiquity.

The abundance of individuals, and also the size and variability of some of the species, seems to show that the island was not inhospitable to the continental genera at the time of the Pliocene. Prof. Heilprin reports that in excavating for one of the docks, specimens of *P. nelsoni* were brought from a peat deposit at a depth of forty feet below sea level. There were not only the large extinct species of *P. nelsoni* and *cupula* and their varieties, but larger varieties of the living species of *bermudensis* and *reinianus*.

*Pilsbry, H.A., Proc. Acad. Nat. Sci. Phila., 1924, p.1.

The extinction of the species that were able to prosper on these parts of the island seems strange. It may have been caused by certain geological phenomena. It is probable that at some time in the past the sand dunes came near the present north shore. Thus, when the Greater Bermuda sank, the change caused the new dunes to be shifted across the section of Lesser Bermuda. *P. bermudensis zonatus* and other snails, *Carychium bermudensis* Gulick and *Euconulus turbinatus* Gulick, not merely survived the subsidence, but even formed a considerable population on the parts of the remaining island that were most affected by the changing conditions. Of the shells that survived this subsidence, *Carychium bermudensis* and *Euconulus turbinatus* are the only snails that are not represented in the collection of the Carnegie Museum.

The living species have been known for a long time, but the discovery of many fossil forms has been recent, within the latter half of the nineteenth century.

***Pæcilozonites cupula* Gulick (Plate XX, Figure 3-4).**

Pæcilozonites cupula Gulick, Proc. Acad. Nat. Sci. Phila., 1904, p. 417, pl. 36, fig. 2.

"The shell is rather thin and the apex dome-shaped. The base is somewhat flattened. The surface of the shell is faintly striate. The whorls are a little convex and increase slowly, the last one vaguely angulate at the periphery. The aperture is somewhat quadrangular, and the peristome is simple and thin, and reflexed at the inner margin. The umbilicus is narrow, deep, and is slightly covered by the reflexed peristome. 7.5 whorls. Altitude 13 mm. and diameter 16." *Gulick*.

Gulick further describes these shells as possessing a pale, shiny epidermis, with subsutural and subperipheral bands of darker color, and faint traces of two narrow bands on the periphery. These characteristics are not distinguishable on the two specimens in the Carnegie Museum as they are much weathered, and are also covered with a deposition of hard, calcareous substance, obscuring many of the external structures.

***Pæcilozonites dalli* Gulick (Plate XX, Figure 1-2).**

Pæcilozonites dalli Gulick, Proc. Acad. Nat. Sci. Phila., 1904, p. 417, pl. 36, fig. 1.

"The apex of the shell is rounded, and the base convex. The surface is polished, with the transverse lines less pronounced than those of *P. cupula*. The shell has a yellowish-brown color with milky-white bands. The whorls are flat as if keeled, but the last one has a blunt

peripheral ridge. The aperture is oblique and roundly-lunate, and the peristome is simple and reflexed at the inner margin. The umbilicus is narrow and partly covered by the reflexed peristome. 7.25 whorls. Altitude 8.5 mm. and diameter 7.3." *Gulick*.

The two shells in the collection of the Museum show a marked difference in the measurement of the altitude and diameter, proving that the one described and figured by Gulick in his article "Fossil Land Shells of Bermuda," must be a juvenile form. However, there may be a possibility that this species is a diminutive race of *P. cupula*, since there exists an extreme variability among the species.

Measurement of the two specimens in the Carnegie Museum are as follows:

| | | |
|-----------------|-------------------|----------|
| Altitude 16 mm. | Diameter 15 mm. | Whorls 8 |
| Altitude 17 mm. | Diameter 16.5 mm. | Whorls 9 |

A third specimen obtained from L. L. Mowbry, which was found twelve feet under the surface in blasting the foundation for St. David's Fort, has a measurement of 18 mm. for its altitude and 16 mm. for its diameter. It has ten whorls.

Another specimen mentioned by Gulick has an altitude of 10 mm. and a diameter of 7 mm., and is composed of 9 whorls. All of the specimens mentioned by him appear to be, as stated before, juvenile forms since the measurements are much less than those in the collection of the Carnegie Museum.

***Pœcilozonites bermudensis zonatus* Verrill (Plate XX, Figure 5-7)**

Pœcilozonites bermudensis zonatus Verrill, Trans. Conn. Acad., New Haven, 1904, p. 164, pl. 26, fig. 1-2, pl. 27, fig. 2, a-1 Types.

"The shell is solid and the apex is almost flat. The surface is coarsely and irregularly striate. A broad chestnut band usually encircles the shell above the periphery, and another below it. The inner whorls of the spire usually retain traces of the original color-pattern of transverse flames. The base is convex, and is not indented around a narrow and deep umbilicus. The parietal wall of the aperture is surrounded by a callous thickening. 7.25 whorls. Altitude 13.5 mm. and diameter 23." *Verrill*.

There appears to be a slight variation in the measurements of the altitude and diameter in this species of *Pœcilozonites*. Addison Gulick records the greatest altitude as 16 mm. and the least as 12.5 mm.; and the greatest diameter as 25 mm. and the least as 20.5 mm. The

largest shell in the collection of the Carnegie Museum has an altitude of 14 mm. and a diameter of 23.5 mm.

Gulick mentions the fact that many of the fossil forms of this species have no callosity on the parietal wall of the aperture. For this reason the words "more or less" could be inserted into the description of the shell, as the author found several shells with this characteristic that they were devoid of such a callosity or of a shining white layer.

In the collection of the Carnegie Museum there are half a dozen shells of this species the description of which fits that of the general description of *P. bermudensis zonatus* with one exception, namely, that the shells possess the peculiar spheroidal upper surface mentioned by A. Gulick to be common to this species.

***Pœcilozonites nelsoni* Bland (Plate XXI, Figure 1-3).**

Hyalina nelsoni Bland, Ann. Lyc. N. H. of N. Y., XI, 1875, p. 78.

P. nelsoni Pilsbry, Proc. Acad. Nat. Sci. Phila., 1888, p. 290, pl. 17, fig. J, K, L.

P. nelsoni Mart., Sitzungsber. Ges. Freude, Berlin, 1889, p. 201.

The shell is solid and the ten whorls form an elevated dome-shaped apex. The surface is very coarsely and irregularly striate. A broad chestnut-colored band usually encircles the shell above the periphery, and another below it, the latter being, however, more or less indistinct. The base is convex and not indented around a narrow and deep umbilicus, which is partially covered by the reflexed peristome. The aperture is almost quadrate, and the parietal wall covered with a shining white layer. The measurements are not definite on account of the great variety of forms. The greatest measurement of the altitude was found to be 33 mm., while the least was 27; and the greatest diameter was 42 mm. and the least 38. These measurements were computed from seven specimens from the collection of the Carnegie Museum.

A. Gulick also found a great variation in the measurement of the shells, the greatest altitude being 34 mm. and the least 19 mm.; while the greatest diameter was 41.5 mm. and the least 33 mm.

H. A. Pilsbry, in his article "On the Helicoid Land Molluscs of Bermuda," says of this species: "As has been observed in other cases of species approaching extinction, and probably subjected to some decided and unfavorable change in its environment, the shell exhibits great mutation and distortion of form; sometimes the spire is elevated conical, sometimes much depressed; frequently the planes of the upper and lower volutions are not parallel, and the spire consequently is canted to one side."

The coloration of these shells is very indistinct or has been entirely

obliterated, due to the fact that they were affected by erosion and covered with a deposition of a hard, thin coating of æolian limestone. According to Pilsbry, the coloration is similar to that of *P. bermudensis*.

***Pæcilozonites nelsoni callosus* Gulick (Plate XXI, Figure 4-5).**

Pæcilozonites nelsoni callosus Gulick, Proc. Acad. Nat. Sci. Phila., 1904, p. 416, pl. 35, fig. 5.

"The shell is smaller than the typical form. The surface is shiny with heavy ribbed striae. A broad yellowish-brown peripheral band encircles the white shell. The whorls increase regularly and gradually. The base has a stronger angle about the umbilical perforation than is usual in this species. The peristome is greatly thickened on the inside from 1 mm. at the suture to fully 2 mm. A prominent callosity covers the parietal wall of the aperture. Whorls a trifle more than nine. Altitude 24 mm. and diameter 33 mm." *Gulick*.

Gulick states, "I suppose the color patterns of *P. nelsoni callosus* were essentially the same as those on the living *P. bermudensis*. The type specimen of *callosus* probably had a dark brown band on a background of a yellowish cuticular color."

The measurements of the two specimens in the collection of the Carnegie Museum are very much greater than those of the average measurements recorded by Gulick. One of the specimens has an altitude of 31 mm. and a diameter of 41 mm.; while the second has an altitude of 31.5 mm. and a diameter of 38.5 mm. These specimens are much weather-worn and are partly covered with a hard, thin deposition of æolian limestone, concealing the color patterns. This covering also obliterates the apical whorls, thereby making the accurate recording of the number of whorls impossible; there seem to be between eight and ten of them. A very distinct callosity covers the parietal wall of the aperture of both of these two specimens.

***Pæcilozonites reinianus antiquus* Verrill (Plate XX, Figure 8-10).**

Pæcilozonites reinianus antiquus Verrill, Trans. Conn. Acad., New Haven, 1904, p. 165, pl. 26, fig. 3.

"The apex is almost flat, and the whorls convex. The surface is rather transversely striated. The color is a cinnamon-buff with many radiating flammules. The base is well rounded, but not angulate at the periphery. The aperture is lunate, due to the more compressed whorls. 7 whorls. Altitude 5-6 mm. and diameter 10-13 mm." *Verrill*.

There is a slight difference in the measurement of both the diameter and altitude of the specimens belonging to the Carnegie Museum and those described by Verrill. The specimens of the Carnegie Museum conform with the greatest diameter of the Verrill specimens, but are only 4 mm. in altitude; on the other hand they are closer in altitude to *P. reinianus goodei* Pilsbry, the measurement of which is 3.25 to 4 mm., but are larger in diameter, that of *goodei* being only 9-10, and rarely more.

***Pæcilozonites blandi heilprini* Pilsbry (Plate XX, Figure 11-13).**

Pæcilozonites blandi heilprini Pilsbry, Proc. Acad. Nat. Sci. Phila., 1924, p. 8, fig. 4d, e, f.

"The apex is decidedly convex, and the base rounded peripherally. The surface is sculptured with fine and low striæ having delicate cuticular edges which are cut into small scales by spiral incisions. The color of the surface is a cinnamon-buff with many reddish-brown radiating flammules above and faint radial streaks beneath. 7 whorls. Altitude 7.3 mm. and diameter 13.6 mm." *Pilsbry*.

This species, and *P. reinianus antiquus*, are the most common of the fossil shells found in æolian limestone.

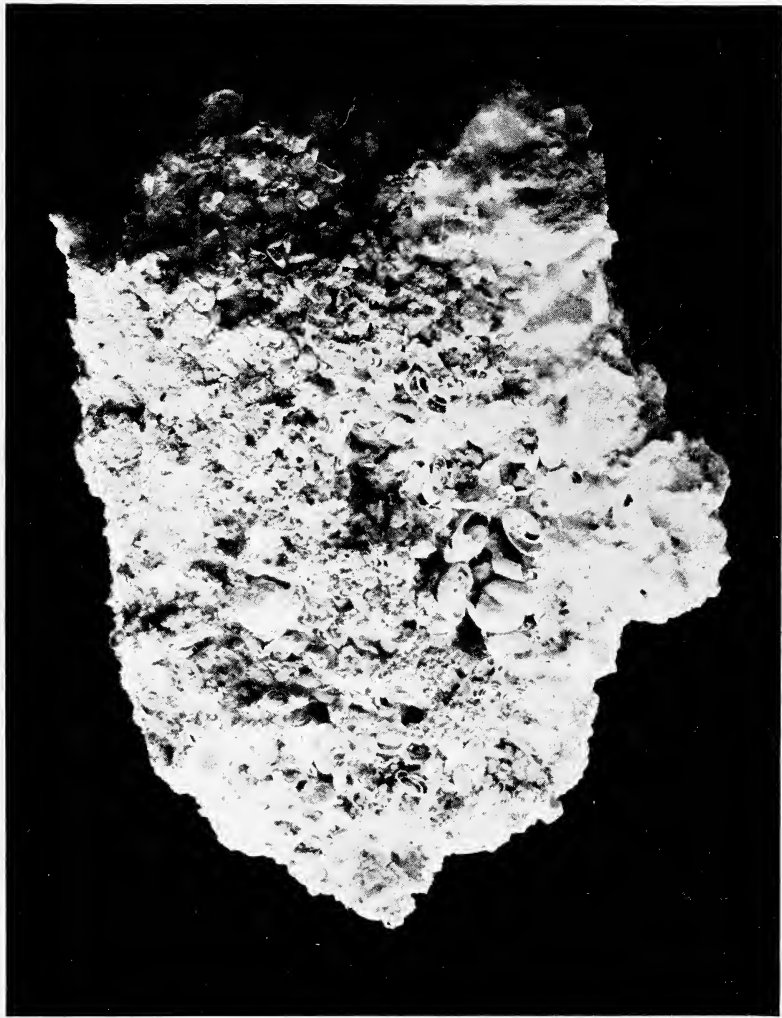
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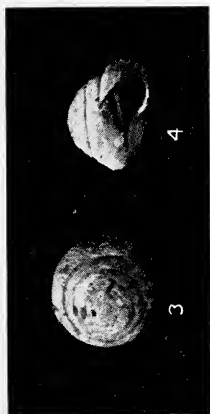
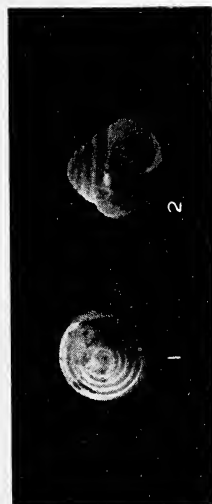
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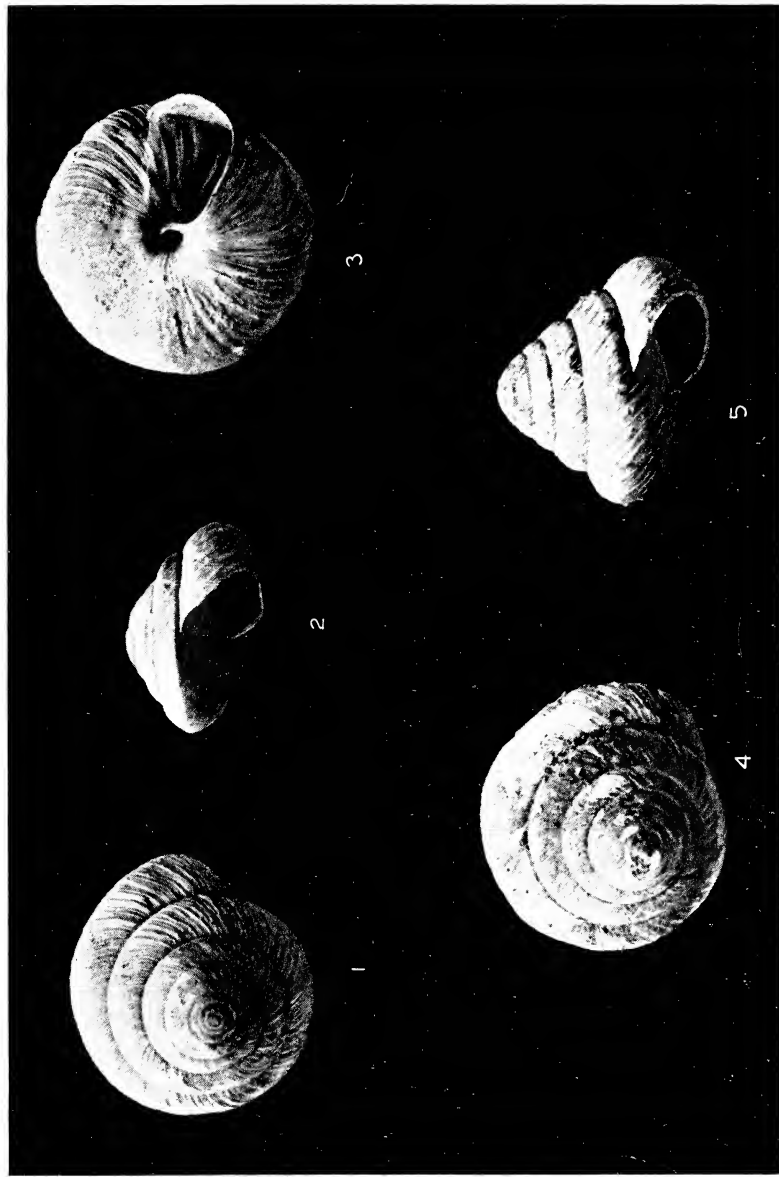


Photograph showing the large number of fossil shells exposed in one of the pieces of Æolian Limestone from Bermuda.



(Approximately natural size)

FIG. 1-2. *Pacilozonites dalli* Gulick. FIG. 5-7. *Pacilozonites bermudensis zonatus* Verrill.
FIG. 3-4. *Pacilozonites reinianus antiquus* Verrill. FIG. 8-10. *Pacilozonites blundi heilprini* Pilsbry.



(Approximately natural size)

FIG. 1-3. *Pacillozonites nelsoni* Bland.

FIG. 4-5. *Pacillozonites nelsoni callosus* Gulick.

ANNELID JAWS FROM THE UPPER DEVONIAN OF NEW YORK.

BY E. R. ELLER.

INTRODUCTION.

The fossil annelid jaws described in this manuscript were collected at Alfred Station and at a gorge two miles to the south, near Tiptop, Allegany County, New York, and are from the Chemung or Canada-way formation of the Upper Devonian. They were found in fine-grained micaceous sandstone and shale. Flat black tubes of substance similar to that of the chitinous-like jaws are also plentiful. These serpulite tubes are about 50 mm. in length and 5 mm. in width. Foerste (1888) suggested that they may represent the chitinous skin of the annelids, the jaws of which are found nearby. This does not seem to be the case in the material under consideration because the jaw apparatus is too large for the size of the tubes. Among the chitinous-like fragments, which are so abundant on the surface of the rock, are plates which are tentatively referred to as elytra or horny scales of the somites. It is hoped that further search may bring to light many more of these interesting fossils.

The writer wishes to acknowledge the valuable assistance of Dr. I. P. Tolmachoff, Curator of the Section of Invertebrate Paleontology at the Carnegie Museum, in the study of the annelid jaws.

DISCUSSION

The literature concerning paleozoic annelid jaws is not very copious. The first known paper described and figured two broken jaws from the Cincinnati group and was published by Grinnell (1877). However, the true nature of these remains had been recognized by paleontologists prior to that date. Hinde (1882), in his paper on the *Annelids of Golland*, records an interesting conversation and communication which he held with Professor Lindstrom in regard to the latter's predecessor, Professor Angelin, who had collected and recognized the true character of these fossils many years ago. Professor Lindstrom

communicated to Hinde some remarks from a letter which he had received from Professor Angelin, dated June 19, 1864, Wisby, which are as follows: "The small hooked fragments from the waterfall near Wisby, of which you furnished me with great numbers, and which, moreover, are met with throughout Gotland, are the remains of Annelids—the jaws and cutaneous coverings." Professor Angelin had figured some examples of these jaws, together with some other fossils, but the plates were never published. According to Hinde the fact is clearly established, that to Professor Angelin "is due the credit of being the first to recognize the true characters of these small fossil jaws, and it gave me great pleasure to be able to bring forward this fresh proof of the knowledge and discernment of this able paleontologist."

The chief work on annelid jaws was carried out by Hinde who published four important papers on the subject. The first, in which he described annelid jaws from the Ordovician, Silurian, and Devonian formations in Canada, and from the Lower Carboniferous in Scotland, appeared in 1879. He discussed in this paper Dr. Heinrich Pander's monograph on fossil fish from the Lower Silurian (Ordovician) in Russia. Hinde believed that the annelid jaws he described under the genus *Eunicites* were very similar to the jaws figured as conodonts by Pander (1856) under the name *Aulocodus obliquus*. The following year, 1880, the annelid jaws from the Silurian of England were described by Hinde and two years later those from the Isle of Gotland. In 1896 he described and figured the articulated jaw, maxilla I, and some related jaws of the genus *Eunicites*.

James (1884) gave descriptions and figures for two new species of *Arabellites* from the Hudson River Group. Clarke (1887) published a plate illustrating a few annelid jaws, together with some conodonts, from the Hamilton group near Canandaigua, New York. One of the specimens figured by Clarke of the genus *Arabellites* is articulated, but is in a somewhat fragmentary condition. Foerste (1888) collected annelid jaws in the Brassfield at Todd's Fork, Ohio, and described and figured six new species. R. Etheridge, Jr. (1890, 1917) described three new species from the Upper Silurian in New South Wales. Some years later he added another species (doubtful) to the Australian list from the Upper Silurian of Bowning, New South Wales. Cleland (1911) figured a single species from the Devonian in Wisconsin. Parks and Fritz (1922) reproduced Hinde's figures and descriptions. Searight (1923) discussed fossil annelid jaws from a

Devonian limestone near Iowa City, Iowa. He did not attempt identification but compared the Paleozoic jaws with those of recent genera. Matern (1933) described a new species of *Nereidavus* from Germany.

The zoological position of fossil annelid jaws was discussed by Ulrich (1879). He compared some jaws from the vicinity of Cincinnati with some modern species and was of the opinion that they were true annelid remains. Ulrich did not figure any jaws in his paper, but it is probable that the material which he had in hand was that of annelids.

Hinde (1879) gave careful descriptions of both conodonts and annelid jaws and gave attention to the differences between these forms. Hinde (1882) submitted some of his Gotland specimens to Professor Ehlers, an authority on both living forms and fossil Solenhofen annelids, and it was his opinion that they were closely related to the families present in existing seas.

Rohon and Zittel (1886) concluded, after a thorough comparative study, that all such structures including the "conodonts" should be referred to as annelids. Miller (1889, 1892, 1897) was convinced that conodonts (including annelid species) were not the teeth of annelids, but belonged to the masticating apparatus of crustaceans. Harley (1861) was also of this opinion. Grabau and Shimer (1910), and Searight (1923) discussed the systematics of annelid jaws.

The classification of paleozoic annelid jaws has always been very difficult. This is due to the mode of preservation, the great variation within a genus and species, and to the asymmetrical variation of the jaws within an individual.

The fossil remains of paleozoic annelid jaws are composed of a substance which is not easily decomposed. They are usually found scattered in a haphazard manner over the surface of rocks and in some of the material under consideration there are approximately two hundred jaws to the square foot. Many jaws are found only in a fragmentary condition because of their brittleness and fineness of structure. With the exception of the articulated specimen figured in this paper, and in two other instances, Clarke (1887) and Hinde (1896), all jaw apparatus is found as isolated jaws. This makes the task of identifying them exceedingly difficult, and Hinde (1879) wrote ". . . I have been obliged to describe the fossil jaws separately but without assuming that each isolated piece belongs to a different species, or even, in some cases, to a different individual, though it may fairly be

supposed, from the very numerous specimens, and their wide distribution in time and space, that there were many species of them." Hinde (1880) restated that in the classification of the jaws he was ". . . thoroughly conscious of its tentative character, as serving for paleontological reference rather than as presenting exact zoological arrangement." Clarke (1887) considered specific identification impracticable, or at best inadvisable. Searight (1924) felt that "until more material has been obtained it does not seem profitable to attempt generic and specific descriptions."

Both fossil and modern annelid jaw apparatus is subject to individual variation and the different paired jaws of the maxilla are often asymmetrical. In the first maxilla the left or right jaw may be heavier than the opposite one, while the jaws of other maxilla may vary in

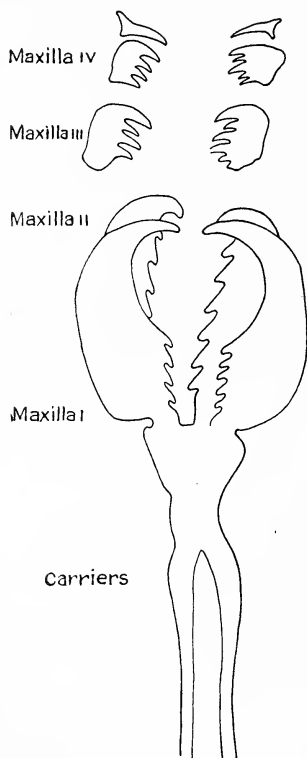


FIG. 1.

Arabella setosa Treadwell.

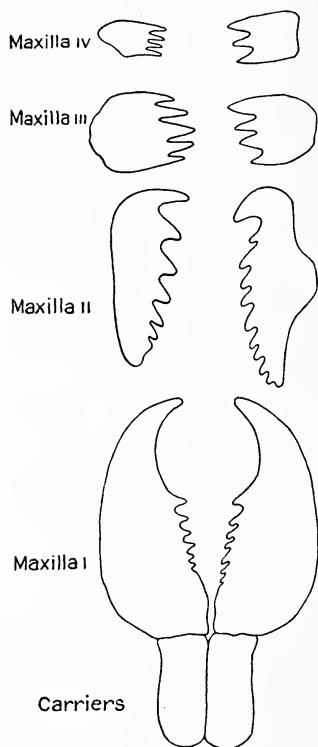


FIG. 2.

Arbellites sp. Schematic representation.

size and the denticles may differ in number. In view of the fact that the jaw apparatus is variable within the genus and species, an exact identification is not considered possible, and until a more satisfactory method is found, the classification will follow that of other authors.

The jaw apparatus of *Arabella setosa* Treadwell, figure 1, is reproduced to show the general arrangement of the jaws of the maxilla. Figure 2 is a schematic reconstruction of *Arabellites* sp.

An isolated plate carrying a series of denticles on the inner free margin is a "jaw." In the jaw apparatus, jaws are found in pairs which are called maxilla I, II, III, IV, etc., the latter term being used in the literature in the singular and sometimes in the plural "maxillæ." The jaws of maxilla I usually end in a prominent curved tooth called a "hook." An extended portion of the anterior margin of a jaw is called a "shank." The two plates at the base of maxilla I are called "carriers."

DESCRIPTION OF SPECIES

Genus EUNICITES, Ehlers, 1868

The annelid jaw apparatus described under the genus *Eunicites* are from maxilla II, III, and IV. No jaws that could be associated with maxilla I were found. Jaws referred to maxilla II are comparatively elongate, rudely triangular with a shank extended from the anterior margin and the free edge furnished with blunt denticles. Jaws of maxilla III and IV are smaller, crudely square or oblong, with a series of blunt or pointed denticles.

***Eunicites anchoralis* sp. n.**

MAXILLA II (Plate XXII, figs. 1-5)

Jaw narrowly lanceolate or triangular; anterior margin wide, slightly rounded, and extended to a pointed shank; outer margin curved anteriorly and then straight to the posterior extremity; free inner margin carries from 7 to 11 large, blunt, triangular denticles. The second denticle is often minute.

This form is similar to *Eunicites cristatus*, Hinde and *Eunicites hebes*, Hinde. Many recent genera besides *Leodice* Savigny (formerly *Eunice* Cuvier) have the jaws of maxilla II of this form and may be compared favorably with them.

Eunicites caulis* sp. n.*MAXILLA II (Plate XXII, figs. 26-28)**

Jaw long and crudely triangular; anterior end greatly rounded and extended to a short pointed shank; outer lateral margin a straight edge, terminating in a blunt posterior extremity; inner lateral margin carries an irregular series of flat, blunt denticles which are often lacking anteriorly.

These jaws are not altogether characteristic of the genus *Eunicites* Ehlers, nor do they resemble very closely the jaws of maxilla II of recent forms. If this form is compared with the foregoing species one may observe that *Eunicites caulis* m. is longer in length, the shank smaller, and the denticles more irregular.

Eunicites mutabilis* sp. n.*MAXILLA III and IV. (Plate XXII, figs. 6-14)**

Jaw irregularly oblong or square; outer margin with aperture for insertion of muscle; inner free margin carries from 3 to 6 denticles which are round and blunt in the larger jaws and acute and conical in the smaller ones.

In general, however, the jaws resemble those of maxilla III and IV of the existing genera *Leodice* Savigny, (*Eunice* Cuvier), and *Arabella* Grube. Hinde considered jaws of this type more closely related to *Leodice*, (*Eunice*). Figs. 10 to 13 are comparable to the jaws of maxilla III and IV, plate XXIII, figs. 2 and 1 of *Arabellites alfredensis* m.

Genus OENONITES, Hinde, 1879

"Jaws with a more or less curved anterior hook, followed by a series of smaller teeth, similar in character to those of the existing genus *Oenone*." Hinde.

Oenonites grandidentatus* sp. n.*MAXILLA II (Plate XXII, figs. 15-25)**

Jaw oblong, tapering posteriorly; denticles very large, flat, blunt, and triangular, the most anterior denticle usually curved and not always the largest. The muscular attachment is under and along the outer margin.

This type of jaw is placed under the genus *Oenonites* by Hinde. They resemble, however, the jaws of maxilla II of *Arabellites alfredensis* m., plate XXIII, fig. 3, quite closely. The resemblance is also close between these fossil jaws and the jaws of maxilla II of the recent genus *Arabella* Grube.

Genus ARABELLITES, Hinde, 1879

"I propose to include in this genus jaws of widely different form, which have a general resemblance to those of the existing genus *Arabella*, Grube.

"1. Jaws with an extremely prominent anterior hook, and a row of smaller teeth on a wide base;

"2. Sickle-shaped jaws and allied forms;

"3. Jaws subquadrate in form, with a straight upper edge of small teeth. Those of the first division appear to correspond with the first pair, the second resemble the second pair, as figured in Cuvier's "*Regne Animal*," of *Arabella (Oenone) maculata*, Edwards; whilst the square-shaped jaws I regard as belonging to the lower jaw of Annelids of this genus. Examples of these different forms are very abundant, not only in the Cambro-Silurian, but in all the other formations where the Annelid remains appear." Hinde.

***Arbellites alfredensis* sp. n.**

MAXILLA I, II, III and IV (Plate XXIII, figs. 1-4)

The articulated jaws of maxilla I, fig. 4, and the three isolated jaws of maxilla II, III and IV, figs. 3, 2 and 1, figured under this species were collected at Alfred Station, New York. A jaw of maxilla II, fig. 3, was found to the right of the jaws of maxilla I, fig. 4, and partly underneath the right one. Less than one inch away the jaws of maxilla III and IV, figs. 2 and 1, were discovered. No other annelid jaws have been found at this locality in four years of intensive collecting. As to size, the jaws are in good proportion to each other and compare favorably to ratios in recent annelid jaw apparatus. For these reasons, and since they were found so close together, it seems more than probable that the jaws are all from the same individual. Thus, they are figured as the same species.

MAXILLA I, fig. 4

Carriers oblong, united along the middle line; posterior margin rounded, with a slight incision; anterior margin truncate with an acute incision; lateral margins irregularly curved but parallel to the middle line; surface sculpture irregular with a protuberance at the anterior margin. The carriers unite with the jaws forming a well defined groove.

Jaw heavy, broad, and asymmetrical, with 6 to 10 curved, conical denticles; lateral margin angularly rounded to the obliquely truncated

posterior margin; 2 to 3 knob-like elevations along the posterior margin; surface irregularly sculptured with gently rounded ridges and furrows parallel to the lateral margins; jaws terminate with stoutly curved hooks which are nearly at right angles to the lateral margins. This form resembles *Arabellites hamatus* Hinde but differs somewhat in size, outline, and surface sculpture.

The wide incision at the distal end of the carriers, the sculpture at the lower part of the inner margin of the jaws, and the presence of the knob-like protuberances suggest that the right jaw slightly overlapped the left one when in operation.

A characteristic of the modern genus *Arabella* Grube, which Hinde used as a comparison for his fossil genus *Arabellites*, possesses very long slender processes or stalks as carriers. The fossil specimen under consideration does not show morphologically any evidence of having had basal stalks or any processes attached to the carriers. The carriers compare more favorably with the modern genus *Lumbrieneris*, de Blainville.

MAXILLA II, fig. 3

Jaw lanceolate; anterior margin rounded and terminating with a robust curved hook; outer lateral margin straight with a large inflation midway; inner lateral margin nearly straight and with 8 heavy, flat, triangular denticles. There are probably two more denticles on the jaw, but they are hidden under the right jaw of maxilla I.

MAXILLA III, fig. 2

Jaw triangular; anterior margin slightly rounded, outer margin irregular and possibly broken; inner margin straight with 5 conical denticles.

MAXILLA IV, fig. 1

Jaw nearly rhomboidal, wider than long; with 5 conical denticles, the first larger than the remaining four.

Hinde (1882) figures under the genus *Arabellites* several secondary jaws, figs. 50-63. None of these, however, compare particularly well with the jaws or maxilla II, III, and IV, figs. 3, 2, and 1, under consideration in this paper. Possibly better comparisons may be made with figs. 11, 16, 17-20, and 25-33 of Hinde's work, described under the genera *Eunicites* Ehlers and *Oenonites* Hinde.

***Arabellites spatiosioris* sp. n.**

MAXILLA I (Plate XXIII, figs. 6, 7)

These jaws resemble *Arabellites alfredensis* m., plate XXIII, fig. 4 in size and general outline, but the surface sculpture is much smoother. They lack also the longitudinal ridges, the furrows, and the knob-like elevations at the proximal margin. The denticles may be considered similar to the foregoing species.

***Arabellites latus* sp. n.**

MAXILLA I (Plate XXIII, fig. 5)

Jaw similar in outline to *Arabellites alfredensis* m., plate XXIII, fig. 4, but is much larger and heavier, and the surface sculpture is more gibbous. The denticles are blunt, flat, and triangular, while those in the preceding species are sharp and conical.

***Arabellites bipennis* sp. n.**

MAXILLA I (Plate XXIII, figs. 8-10)

Jaw elongated; the outer margin curved inward to form a large hook; on the inner margin and perpendicular to it are from 4 to 6 large acute denticles; posterior margin notched by a deep crescent shaped indentation.

The jaws as a whole do not correspond closely to any figured by other authors. Hinde (1882) figured three specimens as *Arabellites spicatus* having the posterior margin incurved. The anterior portion, however, including the hook and denticles, compares rather well with *Arabellites alfredensis* m.

Genus NEREIDAVUS, Grinnell, 1877

Jaws elongate with blunt denticles, a distinct hook and a truncated posterior end. Jaws similar to Grinnell's genus *Nereidavus* were placed under the genus *Eunicites* Ehlers by Hinde (1879), (1880). The jaws under consideration resemble, to some extent, the jaws of the modern genus *Nereis* Linn. Hinde retained the genus *Nereidavus* for forms of this nature, *Nereidavus solitarius* and *Nereidavus antiquus*, and it seems best to follow at this time the precedent set by him.

Nereidavus perlongus sp. n.

MAXILLA I (Plate XXIII, figs. 11-16)

Jaw long and narrow with a prominent terminal hook; posterior extremity obliquely truncated; outer lateral margin gently curved, inner lateral margin nearly straight or slightly curved and furnished with 9 to 11 blunt denticles. The first denticle following the hook is much larger and curved forward. This seems to be characteristic of this form. The under surface has a large aperture, for the insertion of the muscle, which differs in structure in the left and right jaws.

Nereidavus antiquus Hinde is similar in form to *Nereidavus perlongus* m. but is smaller, the posterior end less truncated, and the hook and denticles are not so prominent.

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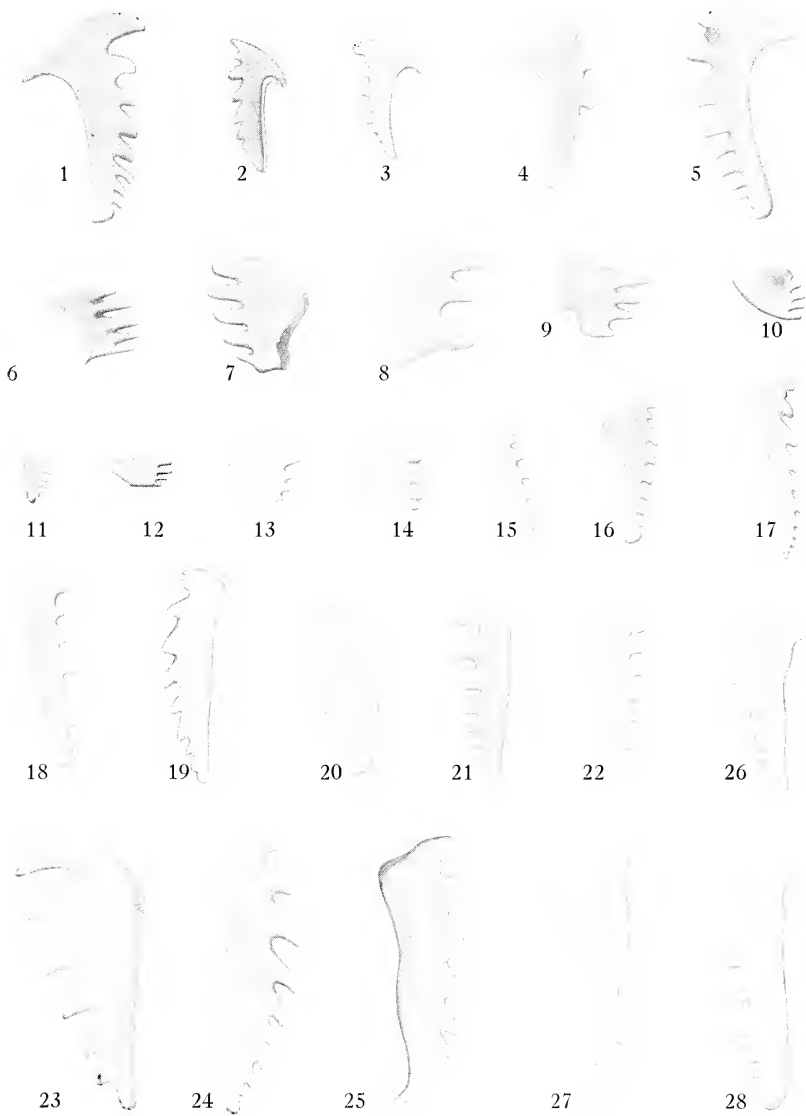
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EXPLANATION OF PLATE XXII.

All figures magnified 13 times.

- FIGS. 1-5 *Eunicites anchoralis* sp. n. Maxilla II, left and right jaws. Tiptop, near Alfred Station, N. Y.
- FIGS. 6-14 *Eunicites mutabilis* sp. n. Maxilla III and IV, left and right jaws. Tiptop, near Alfred Station, N. Y.
- FIGS. 15-25 *Oeononites grandidentatus* sp. n. Maxilla II, left and right jaws. Tiptop, near Alfred Station, N. Y.
- FIGS. 26-28 *Eunicites cautis* sp. n. Maxilla II, left and right jaws. Tiptop, near Alfred Station, N. Y.

All specimens are in the Carnegie Museum under the numbers 6919-6924.



Annelid Jaws from the Upper Devonian of New York.

EXPLANATION OF PLATE XXIII.

All figures magnified 13 times.

- FIGS. 1-4 *Arabellites alfredensis* sp. n. Alfred Station, N. Y.
FIG. 1. Maxilla IV, right jaw.
FIG. 2. Maxilla III, right jaw.
FIG. 3. Maxilla II, right jaw.
FIG. 4. Maxilla I, articulated jaws, upper surface.
- FIG. 5 *Arabellites latus* sp. n. Maxilla I, left jaw, upper surface. Tiptop, near Alfred Station, N. Y.
- FIGS. 6-7 *Arabellites spatiosioris* sp. n., Maxilla I, left and right jaws, upper surface. Tiptop, near Alfred Station, N. Y.
- FIGS. 8-10 *Arabellites bipennis* sp. n. Maxilla I.
- FIGS. 11-16 *Nereidavus perlongus* sp. n. Maxilla I. Tiptop, near Alfred Station, N. Y.
FIGS. 11, 12. Right jaws, upper surface.
FIGS. 13, 14. Left and right jaws, under surface.
FIGS. 15, 16. Left jaws, upper surface.



Annelid Jaws from the Upper Devonian of New York.

ARTICLE V.
ANNALS CARNEGIE MUSEUM
Vol. XXII, April 1934*

VI.
LIST OF TYPES OF
MAMMALS
IN THE COLLECTION OF THE
CARNEGIE MUSEUM

on April 2, 1934

*The student will observe that the pagination in the following article is double. The first numeral indicates the regular pagination in the volume of the ANNALS in which the list originally appeared; the second numeral in parentheses is the pagination to be employed when these lists shall ultimately be gathered together and bound in a separate volume.

V. LIST OF THE TYPES OF MAMMALS IN THE
CARNEGIE MUSEUM.

By J. KENNETH DOUTT.

In the enumeration of specimens of types in the mammalian collection of the Carnegie Museum the name of each species or subspecies is given as it occurs in the original description, followed by a reference to the place and date of its publication. Below this the citations are as follows: (1) Museum catalogue number. (2) Nature of the specimen, whether skin and skull, or skin only. (3) Age and sex of the specimen. (4) Locality where collected. (5) Date when collected. (6) Name of person by whom collected. (7) Original number of specimen. Following this the condition of the specimen at the present time is briefly stated.

Family MUSTELIDÆ.

Mustela arctica semplei Sutton and Hamilton, Ann. Carnegie Mus., 21, No. 2, pp. 79-81, Feb. 13, 1932.

6470. Skin and skull. Adult male. Coral Inlet, South Bay, Southampton Island, Hudson Bay. October 8, 1929. Collected by George Miksch Sutton. Original number, 3 M.

Well-made skin in good condition; skull perfect except for small hole in left parietal, small hole in left maxillary, and loss of tip of left upper canine.

Family SCIURIDÆ.

Sciurus arizonensis catalinæ Douth, Ann. Carnegie Mus., 22, No. 11, pp. 271-273, June 6, 1931.

5612. Skin and skull. Adult female. Near Soldier Camp, Santa Catalina Mountains, Arizona. August 30, 1927. Collected by J. K. Douth. Original number, 130.

Well-made skin in good condition; skull perfect.

Sciurus langsdorffii steinbachi J. A. Allen, Bull. Amer. Mus. Nat. Hist., 33, Article 38, pp. 596-597, October 8, 1914.

(317) (185)

1938. Skin and skull. Adult female. Santa Cruz de la Sierra, Bolivia. July (not June as given in the original description) 14, 1909. Collected by José Steinbach (not T. Steinbach as given in original description). Original number, 358.

Fairly well-made skin in good condition. Skull perfect except for loss of hamular process of each pterygoid and small piece from tip of right postorbital process.

Family MURIDÆ.

Peromyscus polionotus albifrons Osgood, North Amer. Fauna, No. 28, pp. 108-109, April 17, 1909.

1297. Skin and skull. Adult female. Whitfield, Florida. April 17, 1903. Collected by W. E. Clyde Todd. Original number, 28.

A well-made skin in good condition; skull perfect except for a small section broken out of each zygomatic arch; angle broken off right ramus of mandible.

Stenocephalemys albocaudata Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 7-9, pl. I, figs. 1-5, June 6, 1914.

3415. Skin and skull. Adult male. Inyala Camp, Chilalo Mountains, southern Abyssinia. February 18, 1912. [Given as 1911 in original description]. Collected by D. G. R[afferty]. Original number, 11.

Fairly well-made skin in good condition; skull almost perfect. Left zygomatic arch broken and glued together. Posterior two millimeters of septum between anterior palatine foramina broken away. Contact between malar and zygomatic process of temporal loose. Angle of right ramus of mandible broken away; crack running part way into center of ramus.

Otomys jacksoni helleri Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 10-11, pl. III, figs. 1-5. [Labeled *Otomys jacksoni mearnsi* on plate III], June 6, 1914.

3519. Skin and skull. Adult male. Chilalo Divide Camp, Abyssinia; altitude 9,000 ft. February 17, 1912. Collected by E. A. M[earns]. Original number, 7531.

Well-made skin in good condition. Skull badly broken, consisting of following pieces: (1) rostrum containing incisors, nasals, most of maxillæ, all cheek teeth (except posterior right molar), portion of frontals, most of zygomatic processes of maxillaries, and ethmoid; (2) exoccipital, basioccipital, and part of basisphenoid; (3) small portion of supraoccipital, most of interparietal, most of both parietals; (4)

right temporal; (5) mandible with both incisors, most of left ramus, all left cheek teeth; (6) portion of right ramus containing all cheek teeth; (7) small piece of bone from right ramus between incisors and angle.

Otomys jacksoni malkensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 11-12, text fig. 1, pl. III, figs. 6-10, June 6, 1914.

3433. Skin and skull. Adult male. Vicinity of Malka, Sidamo, Abyssinia; altitude 7,000 ft. March 3, 1912. Collected by D. G. R[afferty]. Original number, 29.

Poorly-made skin in fair condition; skull perfect except for large chip off left nasal and small chip off right nasal. Left auditory bulla broken and part of right posterior palatine process broken away. Angle of left mandibular ramus missing.

Gerbillus bilensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 12-14, June 6, 1914.

3511. Skin only. Note on original label reads "Can be mounted skull in skin". The skin has been opened since it was made up and no skull is present now. No skull is figured in original description but measurements for it are given. Adult (?) male. Near Bilen, Abyssinia [original label reads "Sodi Malka"]. December 19, 1911. Collected by E. A. M[earns]. Original number, 7519.

Fairly well-made skin in fair condition; skull lost.

Tatera nigricauda bodessæ Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 14-15, June 6, 1914.

3543. Skin and skull. Adult male. Sagan [spelled Sagon on original label] River, Bodessa, Abyssinia; altitude 5,000 ft. June 6, 1912. Collected by E. A. M[earns]. Original number, 312.

Fairly well-made skin in good condition; skull perfect except for small chip off tip of left nasal.

Tatera vicina bodessana Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 15-17, June 6, 1914.

3534. Skin and skull. Adult male. Bodessa, southern Abyssinia; altitude 5,000 ft. May 25, 1912. Collected by E. A. M[earns]. Original number, 301.

Well-made skin in good condition; skull perfect except for large hole and crack in left auditory bulla, small hole in right auditory bulla, in right supraoccipital, and in orbital plate of left frontal. Angle of left ramus of mandible missing.

Epimys rufidorsalis alettensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 17-18, June 6, 1914.

3435. Skin and skull. Adult female. Aletta, Sidamo, southern Abyssinia; altitude 6,000 ft. [7,500 ft. on original label]. March 6, 1912. Collected by D. G. R[afferty]. Original number, 31.

Poorly-made skin in fair condition. Skull badly broken, consisting of following pieces: (1) rear part of brain case including occipital, interparietal, most of both parietals, part of both temporals, basisphenoid, and both auditory bullæ; (2) small piece of left maxillary containing cheek teeth; (3) two small pieces of right maxillary containing all but one of the cheek teeth; (4) both halves of mandible with both incisors missing. A few small pieces of occipital from another skull are in same vial.

Epimys rufidorsalis ankoberensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, p. 18, June 6, 1914.

3513. Skin and skull. Adult male. Ankober, Shoa, Abyssinia; altitude 7,500 ft. January 23, 1912. Collected by E. A. M[earns]. Original number, 7521.

Fairly well-made skin in fair condition; skull perfect except for very small hole in right parietal. This specimen has been labeled, presumably by Frick, as "*Epimys h. gardulensis*". However the date, locality, and collector's number correspond with the specimen described as *Epimys rufidorsalis ankoberensis*.

Epimys hildebrandti gardulensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 18-19, June 6, 1914.

3447. Skin and skull. Adult male. Gardula, southern Abyssinia; altitude 4,000 ft. March 27, 1912. Collected by D. G. R[afferty]. Original number, 44.

Fairly well-made skin in good condition; skull perfect except for small piece broken out of right zygomatic arch, and angle missing from right half of mandibular ramus.

Arvicanthis abyssinicus blicki Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 20-21, pl. IV, figs. 1-5, June 6, 1914.

3430. Skin and skull. Adult male. Hora Mountain Base Camp, South Chilalo Mountains, Abyssinia; altitude 9,000 ft. February 28, 1912. Collected by D. G. R[afferty]. Original number, 26.

Fairly well-made skin in good condition; skull perfect.

Arvicanthis abyssinicus mearnsi Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 22-23, pl. IV, figs. 6-10, June 6, 1914.

3514. Skin and skull. Adult male. Sodi Malka, Hawash River, Abyssinia; altitude 2,800 ft. January 29, 1912. Collected by E. A. M[earns]. Original number, 7522.

Well-made skin in good condition; skull perfect except for small chip off left nasal, short section broken out of right zygomatic arch, and loss of hamular process of left pterygoid.

Arvicanthis abyssinicus raffertyi Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 23-25, pl. V, figs. 1-5, June 6, 1914.

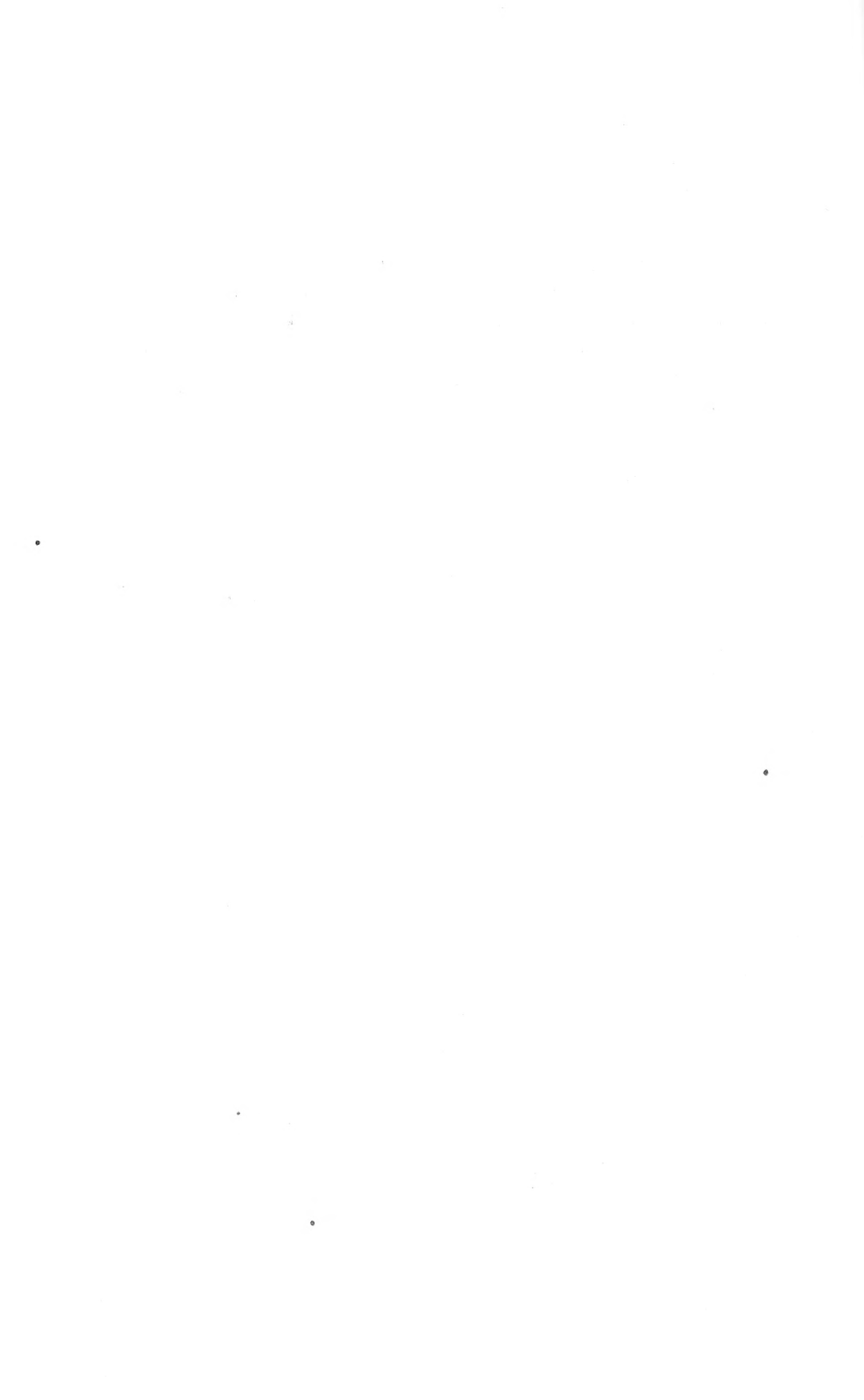
3461. Skin and skull. Adult male. Gardula, southern Abyssinia; altitude 4,000 ft. March 29, 1912. Collected by D. G. R[afferty]. Original number, 59.

Fairly well-made skin in good condition; skull perfect except for small chip out of left squamosal and small piece out of left pterygoid.

Acomys hawashensis Frick, Ann. Carnegie Mus., 9, Nos. 1-2, pp. 26-27, June 6, 1914.

3497. Skin only. Adult female. Sodi Malka, Abyssinia; altitude 3,500 ft. January 31, 1912. Collected by [D. G.] Rafferty. Original number, "A."

Fairly well-made skin in fair condition; hole in crown between right eye and right ear; tail very loose, being held to rest of skin only by loose cotton on tail wire. Note on original label reads, "Broken skull in alcohol?", but skull is not present now.



VI. CARBONIFEROUS INSECTS FROM PENNSYLVANIA
IN THE CARNEGIE MUSEUM AND THE MUSEUM
OF COMPARATIVE ZOOLOGY.

By F. M. CARPENTER.

MUSEUM OF COMPARATIVE ZOOLOGY.

The extensive coal beds of Pennsylvania have produced a surprisingly small number of insects. Up to the present time only 45 species have been described, although more than 80 have been found in the neighboring and more restricted coal beds of West Virginia. The present paper, which I hope is but one of a series on the fossil insects of Pennsylvania, is based upon a relatively large assemblage of specimens in the Carnegie Museum and a few others of unusual interest in the Museum of Comparative Zoology. For the opportunity of studying the Carnegie collection I am indebted to the authorities of the Carnegie Museum, especially Dr. I. P. Tolmachoff.

These new Carboniferous insects are referable to two orders: *Protorthoptera*, with 4 specimens; and *Blattariae*, with 44 specimens. The cockroaches are members of four families, *Archimylacridae* (30 specimens), *Spiloblattinidae* (3 specimens), *Mylacridae* (10 specimens), and *Mesoblattidae* (1 specimen). It is interesting to compare with this collection the insects which have previously been described from the Pennsylvania coal beds. The latter belong to the following orders: *Palaeodictyoptera* (3 specimens), *Protodonata* (1 specimen), *Hapalopteroidea* (1 specimen), *Protorthoptera* (1 specimen), and *Blattariae* (39 specimens). The cockroaches represented 5 families: *Archimylacridae* (11 specimens), *Mylacridae* (23 specimens), *Neomylacridae* (3 specimens), *Pteridomylacridae* (1 specimen), and *Idiomylacridae* (1 specimen). It is therefore apparent that the new material described in this paper adds considerable to our knowledge of the fauna of the region, for two of the families of *Blattariae*, the *Spiloblattinidae*, and *Mesoblattidae*, have not previously been found there. It is peculiar that although the Mylacrids are twice as abundant as the Archimylacridae among the previously described fossils, the latter are three times as numerous as the Mylacridae in the new material.

The localities and horizons at which the fossils described below were collected are as follows:

1. South Good Spring Colliery, 4 miles west of Tremont, Pennsylvania; Mammoth coal vein. Freeport stage of Allegheny formation. The specimens from this locality were collected by W. Victor Lehman and purchased by the Carnegie Museum in 1910 (Collection No. 4032).

2. Swatara Gap, Sharp Mountain, near Tremont, Pennsylvania; Buck Mt. coal. Clarion stage of Allegheny formation. Collected by W. Victor Lehman and purchased by the Carnegie Museum in 1910 (Collection No. 4032).

3. Brookville, Pennsylvania. Mercer group (Appalachian).

4. Pittsburgh, Pennsylvania; Duquesne Shale, Brilliant cutoff. Conemaugh formation. Collected by J. J. Burke (Carnegie Museum Collection No. 9266).

5. Pittsburgh, Pennsylvania. Duquesne coal, Junction hollow, Schenley Park. Conemaugh formation. Collected by J. J. Burke (Carnegie Museum Collection No. 9266).

6. Samples, Pennsylvania; Mason Shales. Conemaugh formation. Collected by P. E. Raymond (Carnegie Museum Collection No. 9272).

7. Aspinwall, Pennsylvania, west side of Allegheny River. Conemaugh formation. Collected by Alfred Emerson.

All of the localities, with the possible exception of Swatara Gap, are new as sources of fossil insects, although the Mammoth vein of coal has already yielded several specimens at other exposures. The South Good Spring Colliery seems to be the most promising locality for further collecting of insects, and probably deserves exploitation for this purpose.

Order **PROTORTHOPTERA.**

Three of the four specimens of this order are sufficiently well preserved to warrant description; the fourth is but a fragment of the middle of a wing and does not show even family relationships.

Family **CALONEURIDAE.**

CALONEURELLA, gen. nov.

Sc terminating just before the apex of the wing; Rs arising at about the middle of the wing, with three terminal branches; M forked

dichotomously proximad of the origin of R_4+5 ; CuA and CuP very close together. The proximal half of the wing is unknown.

Genotype: *Caloneurella carbonaria*, sp. nov.

For a proper appreciation of the systematic position of the new genus and certain allied species the following considerations might be of interest.

The closest relatives of this interesting insect are the *Caloneuridae* from the Carboniferous of Commentry (France) and a series of undescribed fossils from the Lower Permian of Kansas. The latter fossils, which are abundantly represented in the Museum of Comparative Zoology, are decidedly closer to *Caloneurella* than the Commentry fossils. All of these insects are distinguished by two outstanding features of the wings: the proximity of CuA and CuP, the former being an extraordinarily convex vein; and the abundance and strength of the cross-veins, all of which are decidedly convex, giving the wing the appearance of having numerous short wrinkles. In one of the undescribed species from the Kansas Permian the cross-veins are much thicker and heavier than the longitudinal veins.

Since the Carboniferous members of this aggregation of insects are not nearly so well preserved as those from the Permian of Kansas, the discussion of their affinities will be reserved for a later paper dealing with the Kansas material. At present, however, I wish to call attention to certain discrepancies in the accounts of the *Caloneuridae* of Commentry which have made the affinities of the group somewhat uncertain. The following is a list of these insects:

Caloneura dawsoni Brongniart.¹ In this species R_s has at least five terminal branches. Handlirsch (1919) has made several other species from the specimens which Brongniart named *C. dawsoni*. The photographs in figures 5 and 7 of Brongniart's 1894 paper show clearly the strongly convex cross-veins and the wrinkled appearance of the wing.

Caloneura subtilis Bolton.² This fossil shows so little of the media and cubitus that its assignment even to the family Caloneuridae is doubtful.

¹Brongniart, 1885, Bull. Soc. Rouen, 21: 59, pl. 4, fig. 2; 1894, Insectes des temps primaires, p. 562, pl. 52, figs. 5-11. Handlirsch, 1906, Foss. Ins., p. 141, pl. 14, fig. 13; 1919, Denkschr. Akad. Wiss. Wien Kl. 96: 36, fig. 36. Lameere, 1917, Bull. Mus. Paris, 23: 181. Bolton, 1925, Foss. Ins. Brit. Mus., p. 15, fig. 5.

²Bolton, 1925, Foss. Ins. Brit. Mus., p. 16, fig. 6.

Homaloptila similis (Meunier).³ In their figures of this fossil, both Meunier and Handlirsch depict Rs with three terminal branches; Lameere, however, states that CuA is included in Meunier's media. Since Meunier shows the media as consisting of only two branches, this statement of Lameere's indicates that M is an unbranched vein. Handlirsch depicts the media as a forked vein, though he was uncertain of the position of some veins in the wing.

Confusio royeri (Meunier).⁴ Meunier figured this wing with five branches leading from Rs, but Lameere states that there are six. Lameere also contends that the last branch of the media of Meunier's figure is CuA, and the second cubitus of Meunier is 1A. Meunier shows the fork of M almost at midwing, and this is verified by the photograph given by Meunier. Handlirsch depicts Rs with six branches, but he has the media dividing much nearer the base of the wing than is shown in the photograph. According to Lameere the basal part of the wing is narrow, not broad as figured by Meunier. This view of Lameere's agrees with the structure of the Kansas Permian species, in which the wings are decidedly narrowed at the base.

Pruvostilla lecomtei (Pruvost).⁵ In this wing Rs has 3 terminal branches, although more may have been present in the distal part of the wing, which is missing. The media divides at the base of the wing.

From the foregoing account it is apparent that some of the Commeny fossils, especially *C. royeri*, need to be studied further to settle if possible the diverse opinions regarding the structure of Rs and M. It is clear, however, that all these wings have in common the proximity of CuA and CuP, and the numerous, convex cross-veins.

***Caloneurella carbonaria*, sp. nov.** Fig. 1; Plate XXIV, Fig. 2.

Length of preserved part of wing, 15 mm.; estimated length, 45 mm.; width, 7 mm.; costal space broader than the subcostal; Rs dividing at a point well beyond the middle of the wing into R₂, R₃,

³Meunier, 1911, Bull. Mus. H. Nat., 27: 118, fig. 1; 1912, Ann. Palaeont., 7: 8, pl. 6, fig. 5; Lameere, 1917, Bull. Mus. H. Nat., 23: 181. Handlirsch, 1919, Denkschr. Akad. Wiss. Wien Kl. 96: 36, fig. 42-43.

⁴Meunier, 1911, Bull. Mus. H. Nat., 17: 119, fig. 2; 1912, Ann. Palaeont., 7: 9, pl. 7, fig. 2. Lameere, 1917, Bull. Mus. H. Nat., 23: 181. Handlirsch, 1919, Denkschr. Akad. Wiss. Wien Kl. 96: 37, fig. 44.

⁵Pruvost, 1919, Faune cont. houill. N. Fr., 115, pl. 15, fig. 1, 2. Handlirsch, 1921, Foss. cat., Ins. Palaeoz., 82.

R₄+5; M with two terminal branches, the anterior one directed anteriorly after its origin; CuA with a distinct fork near the margin of the wing. Cross-veins very strong and numerous; along the apical

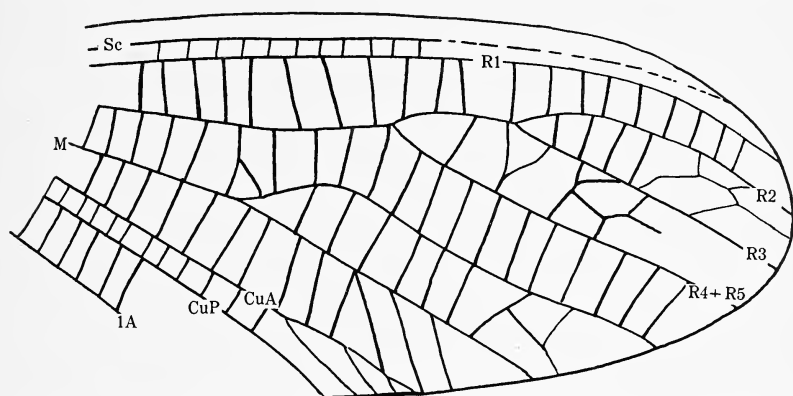


FIG. 1. *Caloneurella carbonaria*, sp. nov., fore wing; drawn from holotype.

area and posterior border there is a coarse network formed by the branching of the cross-veins.

Holotype: Carnegie Museum No. 6894 and 6895. Locality: Mammoth Vein; South Good Spring Colliery; Freeport Stage (Allegheny). The specimen consists of the distal third of a very finely preserved wing.

Family PALAEOCIXIIDAE.

FABRECIELLA, gen. nov.

Allied to *Fabrecia*. Sc terminating on the costal margin before the apex of the wing; costal space broad, traversed by numerous oblique cross-veins; R₁ unbranched; R_s arising proximad of mid-wing, with 4 terminal branches; M dividing at very base into MA and MP; MA with 2 branches; MP with 2-4 branches, CuA forked, the posterior branch (CuA₂) simple, the anterior one (CuA₁) with a series of four short terminal branches leading to the posterior margin.

The new genus *Fabreciella* is obviously very close to *Fabrecia* Meunier and *Palaeocixius* Brongniart, from the Carboniferous of Commentry.⁶ It differs from these two genera in the possession of a much broader costal space, and in the arrangement of the branches of

⁶For description of these fossils see Brongniart (1893), Meunier (1911, 1912), Lameere (1917) and Handlirsch (1919).

MA and MP. This is the first occurrence of the family *Palaeocixiidae* in the Carboniferous rocks of the New World, although several related undescribed species have been found in the Lower Permian of Kansas. Since the latter are more completely preserved, I shall reserve discussion of the affinities of the *Palaeocixiidae* for the paper dealing with the Kansas fossils.

Genotype: *Fabreciella pennsylvanica*, sp. nov.

***Fabreciella pennsylvanica*, sp. nov.** Fig. 2.

Fore wing: Length of preserved part, 17 mm.; width, 5 mm.; apex rounded; Rs with branches R2, R3a, R3b, R4+5; MA dividing distad of first fork of Rs; MP with 4 branches, dividing before first fork in Rs with branches MP1, MP2, MP3, MP4; CuP remote from

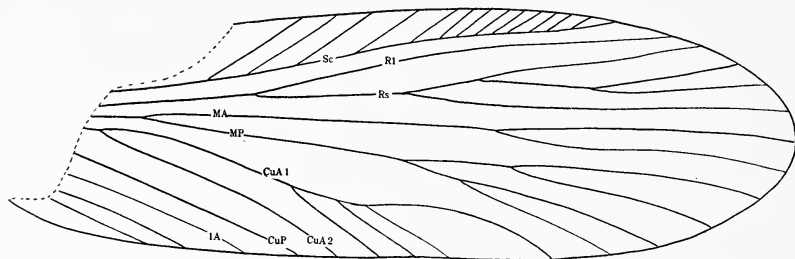


FIG. 2. *Fabreciella pennsylvanica*, sp. nov., fore wing; drawn from holotype.

CuA2; anal veins straight and parallel. The entire wing is coriaceous, with numerous reticulated cells, strongest apically.

Holotype: Carnegie Museum, No. 6896. Locality: South Good Spring Colliery, Mammoth vein; Freeport stage of Allegheny formation. The specimen is very well preserved and lacks only the basal part.

***Fabreciella allegheniensis*, sp. nov.** Fig. 3.

Fore wing: Length of preserved part, 12 mm.; width 5 mm.; estimated whole length, 20 mm.; Rs with branches R2, R3, R4, R5; MA and MP dividing at the same level, at a point distad of the first fork of Rs; CuA shaped as in *F. pennsylvanica*. Basal part of wing unknown.

The species is close to the preceding and I believe it almost certainly belongs to the same genus, although that cannot be determined definitely until the basal portion of the wing is known. The venation

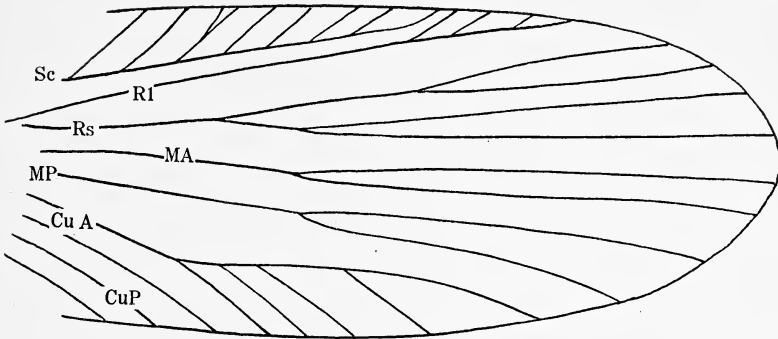


FIG. 3. *Fabreciella allegheniensis*, sp. nov.; fore wing; drawn from holotype.

differs from that of the foregoing by the arrangement of the branches of Rs, and by having only two branches on MP instead of four.

Holotype: Carnegie Museum, No. 6897. Locality: South Good Spring Colliery, Mammoth vein; Freeport stage of Allegheny formation. This specimen consists of the distal half of a well preserved wing.

Order **BLATTARIAE**.

The most striking feature of the Carboniferous insect fauna is the extraordinary abundance of cockroaches, which comprise about 60% of the species of that period. Since most of these consist of single fore wings or tegmina, the classification of this extensive series of insects has been a perplexing problem. The earlier investigators on fossil cockroaches attempted to classify them on such characteristics as the distinctiveness of the venation and the shape of the cellules, but these of course were only individual traits, as shown by Scudder. The latter made an exhaustive inquiry into the classification of fossil cockroaches and proposed to separate the Palaeozoic species from the later ones by placing them in a separate family, *Palaeoblattinidae*. This family was divided into two "tribes," *Mylacridae* and *Blattinariae*, based mainly on the formation of the subcosta. As Handlirsch demonstrated later (1906), Scudder's conception of the evolution of the tegmen of the roaches was quite erroneous, but the characteristics on which he divided the *Palaeoblattinidae* were apparently sound. In his latest work on Palaeozoic cockroaches (1920) Handlirsch recog-

nizes eleven families, of which three, *Archimylacridae*, *Spiloblattinidae*, and *Mylacridae*, include 75 per cent of the species.

Although the phylogeny and fundamental classification of the Blattariae has apparently been established on a sound basis, the lines of demarcation between genera, species, and individuals are still not clear. This is primarily due to the fact that the venation of the roach tegmen is very variable, to such an extent that even the right and left wings of the same specimen usually have a different arrangement of the branches of the main veins. The taxonomy of fossil cockroaches, which consist mainly of tegmina, is therefore rendered especially confusing. I believe that in the past the tendency has been to base species upon individual traits only; this conclusion is substantiated by the fact that with very few exceptions the eight hundred or more species of Carboniferous cockroaches that have been described are known only by unique specimens. Scudder thought that this latter condition itself was indicative of the enormous number of species of cockroaches that existed during the Carboniferous, arguing that since each species was known only by a single specimen, petrification of the insects must have been a rare event; and in that case a large number of species would necessarily have existed in order to produce so many species in the fossil state. A very different view is held by Bolton (1925) who concludes that among the Carboniferous cockroaches "species, as such, scarcely exist, their place being taken" by what he terms *species-groups*. Just what the limits of the *species-groups* are is not clear; but at any rate I believe that in forming this concept Bolton has overlooked the fact that his conclusion was based upon variability of a single structure,—the venation of the fore wing. There are innumerable instances among the recent insects in which one structure, such as the wing venation, is subject to such extreme instability as to be almost useless for the taxonomy of the species. But in these groups other structural characteristics, such as genitalia, are constant and enable us to establish readily a specific classification. The recent cockroaches, themselves, are in this category. Hence, the variability of the venation in the Carboniferous is not sufficient to show that true species did not exist.

The present collection of cockroaches is especially interesting since it includes representatives of certain families and genera which have not been found heretofore in the coal beds of Pennsylvania, or which have not been observed before in the same horizon.

Family ARCHIMYLACRIDAE.

Of the thirty specimens belonging here, only five are sufficiently complete to enable definite generic determination; the others, although clearly *Archimylacrids*, lack certain portions of the tegmen which are essential for further classification, and I prefer to leave them unnamed rather than to add to the long list of uncertain species.

Genus APHTHOROBLATTINA Handlirsch.⁷**Aphthoroblattina handlirschi**, sp. nov. (Plate XXIV, fig. 1).

Tegmen: length of preserved portion, 27 mm.; width 18 mm.; costal area very wide, traversed by numerous subcostal veinlets except at the basal part; R dividing into a distinct R₁ and R_s well before the middle of wing; R₁ and R_s unbranched for some distance from their origins; M arising from the stem of R at the base, not dividing until well beyond the origin of R_s; Cu joined to stem of R and M, CuP diverging posteriorly a short distance beyond the origin of M; CuA well developed, with at least six main branches; CuP deeply concave, only slightly curved; 1A remote from CuP basally but converging towards it distally. The membrane of the wing consists of the primitive archidictyon characteristic of the *Phyloblatta* group of the family. This archidictyon is clearly seen in the photograph (figure 1, plate XXIV).

I take pleasure in naming this insect for Dr. Anton Handlirsch. The type specimen is beautifully preserved, although the distal third or even half of the wing has broken away. It is one of the most generalized cockroaches which has been found, though not so primitive as *Palaeoblatta pancinerois* Scudder. The genus *Aphthoroblattina* has been known previously from 4 species, *A. fascigera* Scudder, *A. johnsoni* Woodward, *A. carbonare* Handlirsch, and *A. eggintoni* Bolton. The tegmen is incompletely known in all of these and *A. handlirschi* sp. n. shows more detail than any of the other specimens.

Holotype: No. 3345, Museum of Comparative Zoology. Locality: Brookville, Pennsylvania, Mercer group (lower Westphalian). The specimen was in the Scudder collection but probably reached him after he had discontinued active work on fossil insects.

⁷Handlirsch, 1906, Proc. U. S. Nat. Mus. 29: 719.

Genus *HEMIMYLACRELLA* Handlirsch 1921.⁸***Hemimylacrella mammothi*, sp. nov.** Fig. 4.

Tegmen: length, 21 mm.; width, 9 mm.; costal space broad; Sc terminating at about mid-way, sending several branches to the margin; R well developed, with seven main branches, but without a definite R₁; M curves away from R near mid-wing, but approaches it distally; M with 4 main branches directed posteriorly; CuA well de-

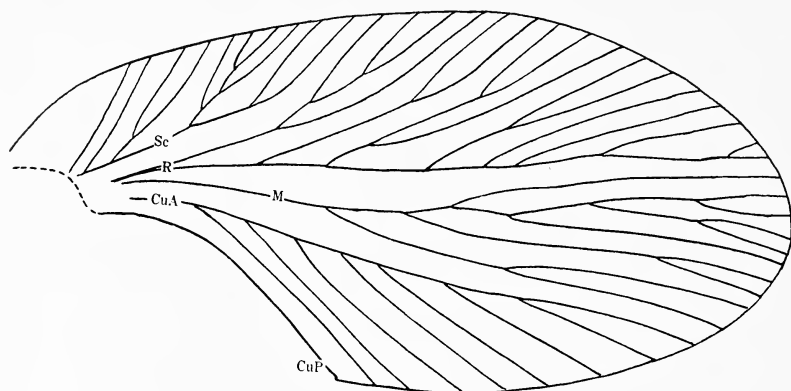


FIG. 4. *Hemimylacrella mammothi*, sp. nov.; fore wing; drawn from holotype.

veloped, with 8 main branches; anal area missing. The archiedictyon is visible in many parts of the wing.

The only other species of this genus is *H. ramificata* Handlirsch, from Sharp Mt. Gap, near Tremont, Pennsylvania. *H. mammothi* is very close to the genotype but differs in having the branches of Sc arranged in a definitely pectinate manner. In *H. ramificata* the branches arise almost radially, a condition which originally prompted Handlirsch to place this fossil in the *Mylacridae*. The genus *Hemimylacrella*, together with the related *Hemimylacris*, is more or less on the border line between the *Archimylacridae* and *Mylacridae*.

Holotype: Carnegie Museum, No. 6898 and 6899. Locality: South Good Spring Colliery; Freeport stage, Allegheny formation. The specimen is very well preserved, but lacks the anal area.

⁸Handlirsch, 1921, Cat. Foss., Palaeoz. Ins., p. 117.

Genus *PLAGIOBLATTA* Handlirsch 1906.⁹*Plagioblatta cockerelli*, sp. nov. Fig. 5.

Tegmen: length 20 mm.; width, 8 mm.; slender; costal area wide; Sc terminating well beyond mid-wing; R very well developed, its first branch arising proximal of mid-wing and its last branch terminating at the very apex; M reduced, directed posteriorly almost immediately

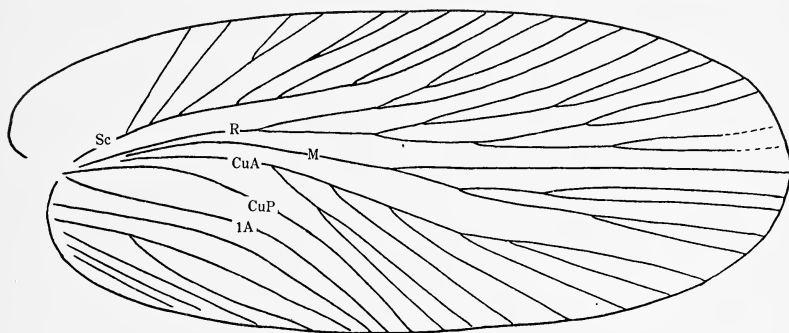


FIG. 5. *Plagioblatta cockerelli*, sp. nov., fore wing; drawn from holotype.

after its origin, forked dichotomously before mid-wing; CuA of moderate size, with 5 main branches, the first 2 branches being very long; CuP slightly curved; 1A and 2A unbranched. 3A deeply forked; anal area narrow.

This species is named for Professor T. D. A. Cockerell, who in addition to his other numerous writings on fossil insects has given us an extensive account of the Carboniferous insects of Maryland.

Plagioblatta is another genus which has previously been found in Pennsylvania, there being two species, *P. parallela* Handlirsch and *P. campbelli* Handlirsch. From both of these the present species differs by having all of the branches of Rs above the longitudinal axis of the wing, and by having a narrow anal area.

Holotype: Carnegie Museum, No. 6900. Locality: South Good Spring Colliery, Mammoth vein; Freeport stage, Allegheny formation. The type specimen is complete and well preserved. There is another specimen in the Carnegie collection (No. 6901) which seems to be another representative of the insect, though there are a few more branches on the distal part of CuA.

⁹Handlirsch, Proc. U. S. Nat. Mus., 29: 721.

Genus PHYLOBLATTA Handlirsch 1906.¹⁰**Phyloblatta pennsylvanica**, sp. nov. Fig. 6.

Tegmen: length, 20 mm.; width, 10 mm.; costal area broad; Sc terminating beyond mid-wing; R well developed, no distinct R₁; last branches of R terminating at the very apex; M sending 2 branches

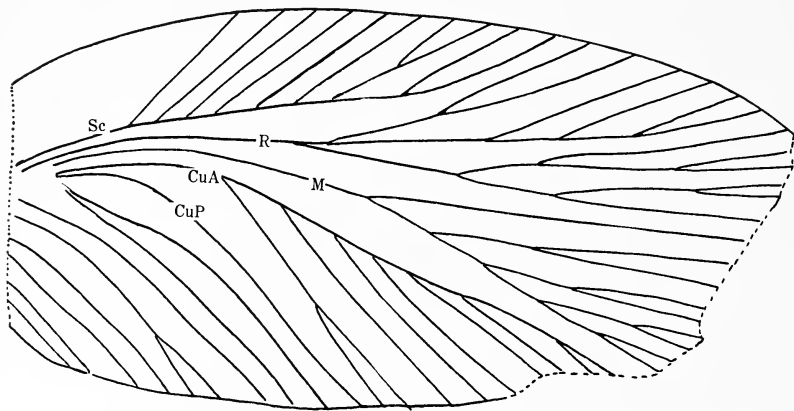


FIG. 6. *Phyloblatta pennsylvanica*, sp. nov., fore wing; drawn from holotype.

anteriorly; CuA well developed, the basal branches very long; CuP curved at base but nearly straight beyond; 1A distinctly forked.

The large genus *Phyloblatta*, which includes a great number of species from the coal beds of West Virginia, has not previously been found in Pennsylvania. The present species is a characteristic species of the genus and resembles some of the West Virginia species so closely that it may eventually turn out to be identical with one of them.

Holotype: Carnegie Museum, No. 6902. Locality: East Good Spring Colliery, Mammoth vein; Freeport stage, Allegheny formation. The specimen is complete except for the very base and the tip of the wing.

Genus SCHIZOBLATTA 1906 Handlirsch.¹¹**Schizoblatta pennsylvanica**, sp. nov. Fig. 7.

Tegmen: length, 25 mm.; width, 9 mm.; rather slender; costal margin strongly curved; Sc terminating at about mid-wing; R without a distinct R₁, the first branch of R arising well before the middle of the wing; M sending out the first branch at about mid-wing, the

¹⁰Handlirsch, Proc. U. S. Nat. Mus., 29: 731.

¹¹Handlirsch, Proc. U. S. Nat. Mus., 29: 722.

branches of M directed more or less anteriorly; CuA very large, the first branches very long and arising close to the base of the wing: CuP joined to CuA at the base, smoothly curved.

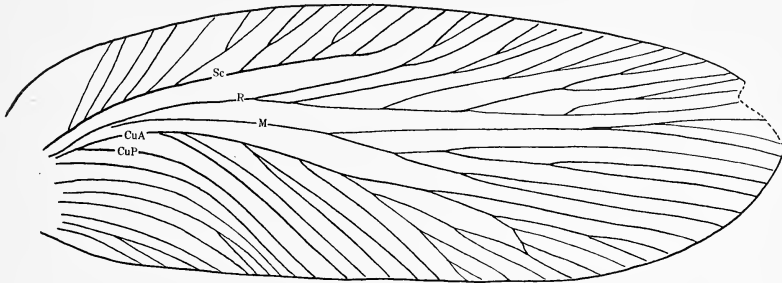


FIG. 7. *Schizoblatta pennsylvanica*, sp. nov., fore wing; drawn from holotype.

The genus *Schizoblatta* has previously been known only from one species, *S. alutacea* Handlirsch, from Ohio (Conemaugh). The present species is close to the latter, but is decidedly more elongate and has a larger CuA and a smaller R. There is a second tegmen in the Carnegie collection (No. 6904) which probably belongs here. The venation is very nearly the same as in the type, but the tegmen is much smaller and differently shaped. The latter indicates that tegmen belonged to an immature individual, hardly half-grown.

Holotype: Carnegie Museum No. 6903. Locality: Mammoth Vein, South Good Spring Colliery, Pennsylvania; Freeport stage, Allegheny formation. The specimen is complete and very well preserved.

Family SPILOBLATTINIDAE.

Genus SYSCIOBLATTA Handlirsch 1906.¹²

Syscioblatta allegheniensis, sp. nov. Fig. 8.

Tegmen: length of preserved part, 25 mm.; width, 9 mm.; slender and pointed; costal margin not very strongly arched; Sc terminating beyond the middle point of wing; R1 distinct and possessing numerous branches; Rs also well developed, arising proximad of mid-wing, with all branches anterior to the longitudinal axis of the wing; M not branching until distal of mid-wing, sending the branches anteriorly; CuA very well developed, prolonged distally and running parallel with the posterior margin for a short distance; CuP quite remote from the basal part of CuA as preserved in the fossil.

¹²Handlirsch, Proc. U. S. Nat. Mus., 29: 760.

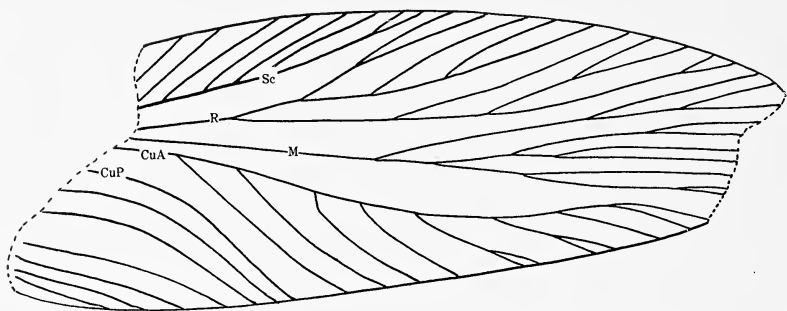


FIG. 8. *Syscioblatta allegheniensis*, sp. nov., fore wing; drawn from holotype.

The genus *Syscioblatta*, although well represented in the Carboniferous of Ohio and Kansas, and with one species (genotype) in the Carboniferous of Germany, has not previously been collected in Pennsylvania. This species and the following are very characteristic members of the genus. *S. allegheniensis* is distinguished from all other species by the very pointed tegmen.

Holotype: No. 3346 Museum of Comparative Zoology. Locality: Aspinwall, Pennsylvania, west side of Allegheny River (A. Emerson); Conemaugh formation. The specimen, which is finely preserved, is nearly complete, lacking only the very tip and part of the base of the tegmen.

***Syscioblatta pennsylvanica*, sp. nov. Fig. 9.**

Tegmen: length of preserved part, 19 mm.; width, 8 mm.; rather broad; costal margin strongly curved; Sc terminating just beyond

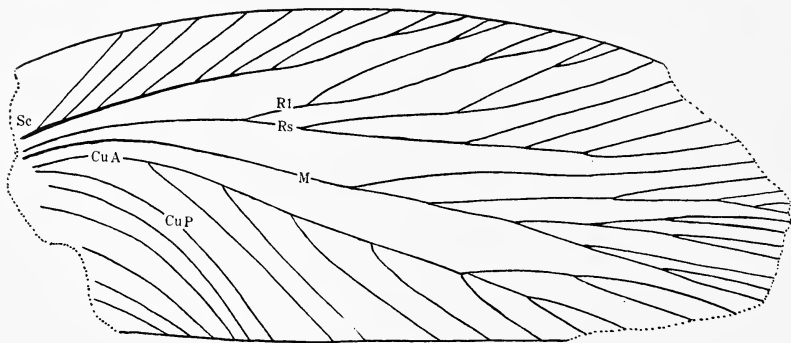


FIG. 9. *Syscioblatta pennsylvanica*, sp. nov., fore wing; drawn from holotype.

mid-wing; R₁ distinct, but with fewer branches than in the foregoing species; all branches of R_s anterior of the longitudinal axis of wing; M directed posteriorly much more than in *S. allegheniensis*, the branches leading anteriorly; CuA well developed, with the distal part parallel with the posterior margin for a short distance; CuP uniformly curved.

This tegmen is close to the preceding, but differs in being proportionally broader, and in having the anterior margin much more strongly curved.

Holotype: Carnegie Museum, No. 6909. Locality: Duquesne Shale, Junction Hollow, Schenley Park, Pittsburgh, Pennsylvania; Conemaugh formation. The specimen is very well preserved, but lacks the apex and a small part of the base.

Family MYLACRIDAE.

Of the ten specimens of Mylacids in the material at hand only three are well enough preserved for generic determination. Some of the others may be identical with the three described below, but they do not show enough of the venation to enable us to assign them to any species.

Genus ACTINOMYLACRIS Handlirsch 1906.¹³

Actinomylacris similis, sp. nov. Fig. 10.

Tegmen: length of preserved part, 13 mm.; width, 7 mm.; Sc reduced to 3 branches, two of which are forked; R_s extending almost to the apex of the wing; M not branched until about mid-wing, its branches directed posteriorly; CuA narrow, the branches crowded,

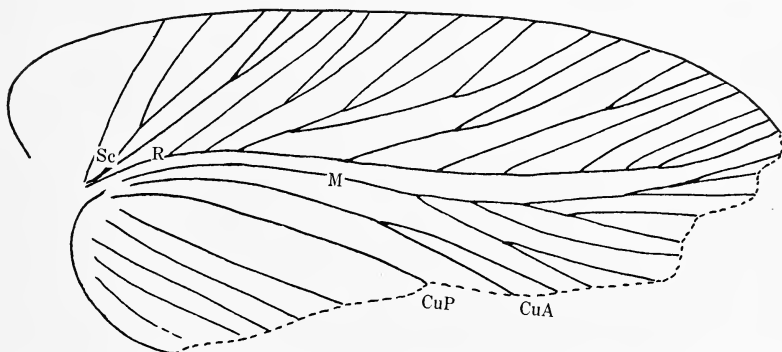


FIG. 10. *Actinomylacris similis*, sp. nov., fore wing; drawn from holotype.

¹³Handlirsch, Proc. U. S. Nat. Mus., 29: 773.

the first branch arising close to base of wing; CuP straight for nearly its entire length; 1A remote from CuP.

This tegmen is very close to that of the other species of the genus, *A. carbonum* Scudder and *A. vicina* Handlirsch, the latter being from the Mammoth coal at Fremont. I was at first inclined to regard it as a small specimen of *A. vicina*, but it has a perfectly straight *vena dividens* (CuP), not a curved one, as in *A. vicina*, and the nature of that suture is probably one of the few structures in the cockroach tegmen that are constant.

Holotype: Carnegie Museum, No. 6907 and 6908. Locality: Mammoth vein, South Good Spring Colliery; Freeport stage, Allegheny formation. The specimen lacks the apex and most of the posterior margin.

Genus *STENOMYLACRIS* Handlirsch 1906.¹⁴

Stenomylacris emersoni, sp. nov. Fig. 11.

Tegmen: length, 25 mm.; width, 12 mm.; broad; distal branch of Sc terminating at about mid-wing; R very large, branching from the very base of the wing, but all branches anterior of the longitudinal axis of the wing; M also large branching near the base, the upper-

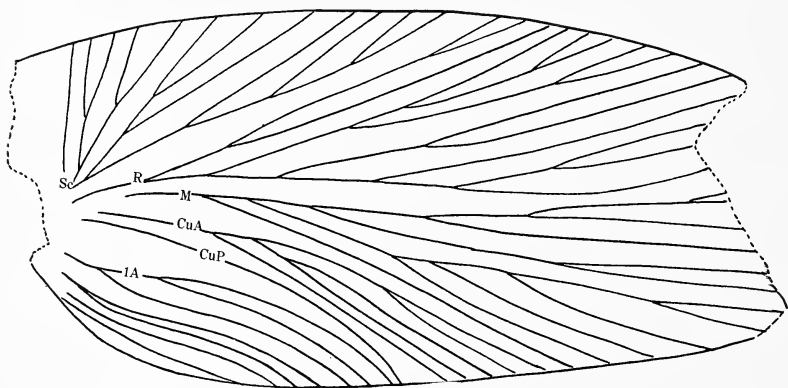


FIG. 11. *Stenomylacris emersoni*, sp. nov., fore wing; drawn from holotype.

most branches forming a straight line coinciding with the axis of the wing; CuA rather small, with only 3 main branches; CuP evenly curved; 1A remote from CuP basally, giving rise to 3 terminal branches.

¹⁴Handlirsch, Proc. U. S. Nat. Mus., 29: 773.

This is only the second species of *Stenomylacris* which has been found, the other being *S. elegans* Handlirsch, from the Mammoth coal, near Fremont, Pennsylvania. *S. emersoni* differs from the genotype by having all branches of Rs anterior of the longitudinal axis of the wing, which is not true of *S. elegans* Handlirsch.

Holotype: No. 3347, Museum of Comparative Zoology. Locality: Aspinwall, Pennsylvania, west side of Allegheny River; Conemaugh formation; collected by Dr. Alfred Emerson, for whom the species is named. The fossil consists of a well preserved tegmen, lacking the very apex of the wing.

NEOSIMPLICIUS gen. nov.

Allied to *Simplicius* Handl. Sc radiate, but long; R without a distinct R₁, possessing numerous branches which include the apical area of the wing; M greatly reduced, with only a few distal branches; CuA long, but with few branches; CuP joined to CuA near the base, slightly curved, and distinctly forked distally.

This remarkable genus is distinguished from all others of the Mylacridae by the reduced media and the fork on CuP as well as by the curious structure of CuA. The insect seems to be more closely related to *S. simplex*, from Danville, Illinois, than to any other genus, for in this also the media is reduced to a forked vein.

Genotype: *Neosimplicius medialis*, sp. nov.

Neosimplicius medialis, sp. nov. Fig. 12.

Tegmen: length, 20 mm.; width, 7 mm.; costal margin nearly straight, apex blunt; Sc extending far beyond mid-wing, all its branches arising from a single stem; R with at least 5 main branches, arising

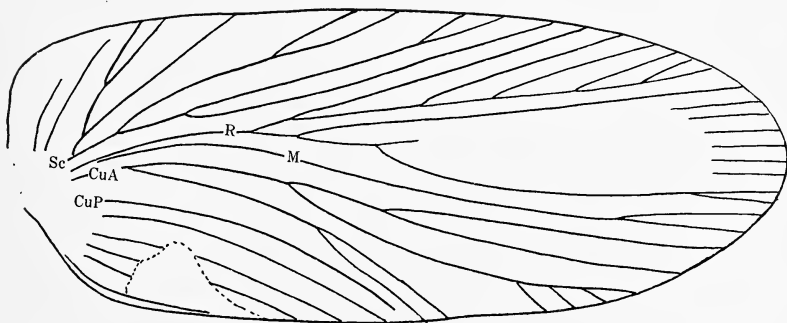


FIG. 12. *Neosimplicius medialis*, sp. nov., fore wing; drawn from holotype.

proximal of mid-wing; M slightly sinuate, with a single distal fork; CuA with a posterior branch arising before mid-wing and sending 3 short veinlets to the posterior margin; CuP forked to half its length; anal veins equidistant.

Holotype: Carnegie Museum, No. 6905 and 6906. Locality, Swatara Gap, Buck Mt. Coal vein, Sharp Mt., near Tremont, Pennsylvania, Clarion stage, Allegheny formation.

Family MESOBLATTINIDAE.

This highly specialized family, characterized by the absence or near absence of Sc, has been represented by only two species in the American Carboniferous, and both of these are in shales above the Ames Limestone, near Richmond, Ohio. I was much surprised, therefore, to find a typical specimen in the material collected by Dr. Emerson. Eventually, a new genus may be required for this species, but for the present I have placed it in a genus containing one of the Ohio species.

Genus ACMAEOBLATTA Handlirsch 1906.¹⁵

¹⁵Handlirsch, Proc. U. S. Nat. Mus., 29: 793.

Acmaeoblatta carbonaria, sp. nov. Fig. 13.

Tegmen: length of preserved part 8 mm., whole length probably 9 mm.; width 3.7 mm. Sc absent. R well developed, some branches extending nearly to the apex of the wing; M fused with R basally, but curving towards the posterior margin soon after its origin; all branches of M directed anteriorly or at least apically; CuA small,

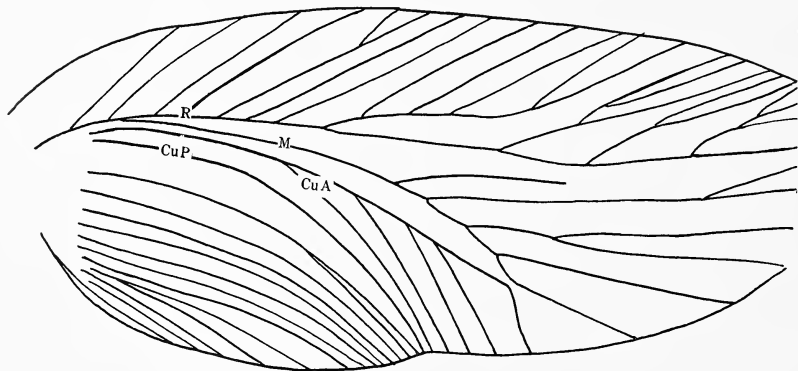


FIG. 13. *Acmaeoblatta carbonaria*, sp. nov.; fore wing; drawn from holotype.

sending 5 straight, parallel branches to the posterior margin and coalescing with M distally, forming a closed cell; anal area large; CuP uniformly curved.

This tegmen has all the characteristics of the Mesoblattinids, and in the coalescence of M and CuA is even more highly specialized than the other members of the family. In the specimen at hand the first branch of M apparently disappears into the wing membrane, but this is almost certainly an individual feature. The tegmen is strongly convex like that of most Mesoblattinids.

Holotype: No. 3348, Museum of Comparative Zoology. Locality: Aspinwall, Pennsylvania, west side of Allegheny River; Conemaugh formation; collected by Alfred Emerson. This specimen is well preserved and complete except for the very tip of the wing.

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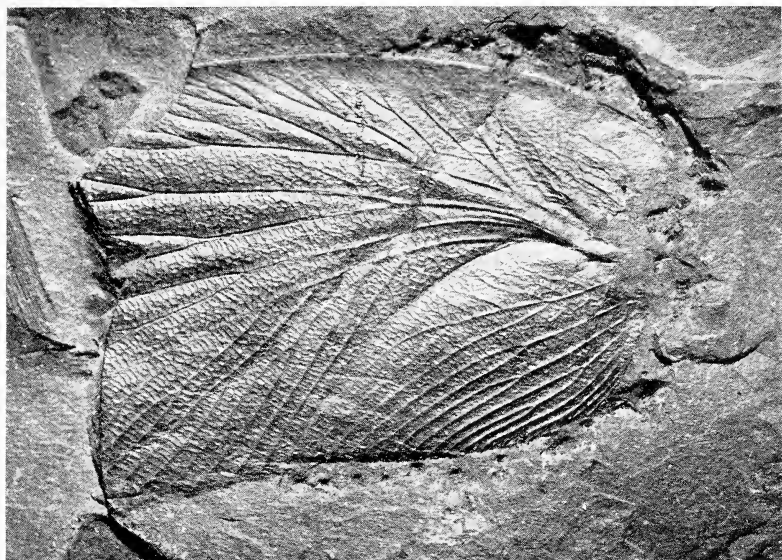


FIG. 1. *Aphthoroblattina handlirschi*, sp. nov.; holotype, No. 3345, Museum of Comparative Zoology. Note the distinct archdictyon.

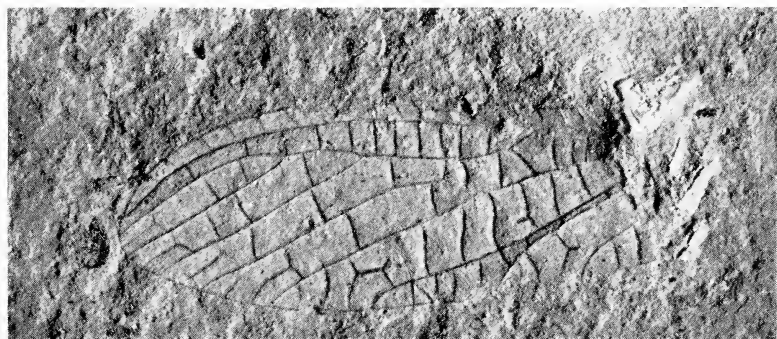


FIG. 2. *Caloneurella carbonaria*, sp. nov.; holotype, Carnegie Museum, No. 6894. Note the thickness and convexity of the cross-veins. About x5.

THE OSTRACODS OF THE NINEVEH LIMESTONE OF PENNSYLVANIA AND WEST VIRGINIA

By

WILBUR C. HOLLAND

INTRODUCTION

The Nineveh Limestone is a thin-bedded fresh water limestone in the upper part, or in the Greene group, of the Dunkard Series of the Permian. Its areal distribution is confined to the southwestern part of Pennsylvania, chiefly Washington and Greene Counties, and to a narrow belt along the upper part of the Ohio River in West Virginia and Ohio. The Nineveh Limestone horizon consists of an alternation of thin, lenticular limestones and shales with a total thickness of about five feet.

The fauna of the Nineveh Limestone is composed entirely of fresh water forms. Ostracods are the only fossil universally distributed in this horizon. Fish teeth and scales, a minute gastropod of the *Pupidae* family, and *Spirorbis* may be found in certain localities of this region.

The *Ostracods* described in this paper were collected from two localities. The first collection was made at Limestone Hill in Wood County, West Virginia, and later material was collected from Nineveh, in Greene County, Pennsylvania.

The writer wishes to express his appreciation to Professor R. W. Whipple of Marietta College for suggesting the problem and to Doctor I. P. Tolmachoff of the Carnegie Museum for advice in the identification of the specimens.

SYSTEMATIC DESCRIPTIONS

Family APARCHITIDÆ Ulrich and Bassler

Genus WHIPPLELLA n. gen.

Outline of carapace elliptical to sub-ovate; dorsal aspect ovate to cuneiform. Dorsal margin always arched; ventral margin convex, straight, or slightly concave. Hinge line short, straight, and partially hidden by the protruding shoulder of the one valve. Anterior and posterior ends either rounded or truncated. Surface smooth or pitted.

Eye spots present on the blunter end in some of the species distinguish this as the anterior end. In *Whipplella deltoidea* n. sp. the position of the eye is marked by a group of small tubercles situated just below the median line on the thicker end. In *Whipplella depressa* n. sp. the eye spot is characterized by a change in the type of ornamentation at the place of maximum thickness.

The main characteristic of the genus is its type of overlap. The left valve is the larger and overlaps the right all the way around except along the hinge line where the right valve overlaps the left and generally protrudes over it. The overlap of the left valve over the right is greatest along the middle part of the ventral margin. The two valves may meet evenly along the anterior and posterior ends, or the left valve may overlap the right.

This genus is named in honor of Professor Ralph W. Whipple of Marietta College.

Genotype: *Whipplella cuneiformis* n. sp.

Range: Permian.

Whipplella resembles, in some respects, the genus *Paraparchites*. The overlap in the two genera is, however, just opposite. The right valve of *Paraparchites* overlaps the left along the ventral margin and, at the hinge line, the left valve protrudes over the right. There are also other points which differentiate the two genera. *Paraparchites* commonly has a straight dorsal margin whereas the dorsal margin of *Whipplella* is always arched. In *Paraparchites* the right valve sets into a groove in the left to form the hinge, but in *Whipplella* the hinge is a simple overlap. With the exception of three species, *Whipplella deltoidea* n. sp., *Whipplella magnitata* n. sp., and *Whipplella ninevehensis* n. sp., the outline of the carapace does not resemble that of *Paraparchites*, being more elongated and more obese. The pitted ornamentation present in most species of *Whipplella* is apparently not found in *Paraparchites*.

***Whipplella cuneiformis* n. sp.** (Plate XXV, fig. 5)

Carapace ovate in outline; dorsal view cuneiform. Greatest length just below the median line; greatest height about the middle; greatest thickness one-third of the way from the anterior end along the median line. Hinge line short, occupying about one-fourth of the total length of the shell. Dorsal margin arched; ventral margin convex.

The left valve overlaps the right on all sides except along the hinge line where the overlap is reversed.

Surface ornamentation consists of small, shallow, nearly circular pits which are better developed on the anterior part of the shell. Ornamentation is absent on the overlapping portions of the shell as well as along the posterior end.

Dimensions: maximum length: .84 mm.
maximum height: .59 mm.
maximum thickness: .61 mm.

Whipplella cuneiformis n. sp. closely resembles *Whipplella depressa* n. sp., described in this paper, but differs in the structure of the hinge and in the character of ornamentation.

Holotype: Carnegie Museum No. 6493.

Horizon and locality: Nineveh Limestone at Limestone Hill, West Virginia.

***Whipplella depressa* n. sp.** (Plate XXV, fig. 7)

Carapace sub-rectangular; dorsal view ovate. Greatest length along the median line; greatest height in front of the center; greatest thickness just below the median line, one-third of the way from the anterior end. Hinge line short and straight, depressed between the two equal shoulders of the valves. Dorsal margin arched; ventral margin nearly straight.

The left valve overlaps the right on all sides except along the hinge line where the overlap is reversed. The dorsal overlap is slight.

The surface is coarsely pitted. The pits being irregularly elongate tend to parallel the margins of the shell, especially along the posterior end. The pits cover the entire surface of the shell except the overlapping portions. Two or three larger pits at the place of maximum thickness mark the position of the eye spot.

Dimensions: maximum length: .76 mm.
maximum height: .50 mm.
maximum thickness: .46 mm.

Whipplella depressa n. sp. is distinguished from the other species of this genus by its depressed hinge line. Its ornamentation is much coarser than in any species of *Whipplella* described.

Holotype: Carnegie Museum No. 6491.

Horizon and locality: Nineveh Limestone at Limestone Hill, West Virginia.

***Whipplella deltoidea* n. sp.** (Plate XXV, fig. 1)

Carapace rather large and sub-circular in side view; dorsal view elliptical. Greatest length below the median line; greatest height about the middle; greatest thickness in front of the center along the

median line. From the hinge line the anterior border extends downward at about 135 degrees to a point below the median line, thus truncating the anterior end. The posterior end is broadly rounded. Dorsal margin highly arched; ventral margin convex.

The left valve overlaps the right on the ventral side; on the dorsal side the right valve overlaps the left and protrudes over it so as to obscure the hinge. A slight sinuosity in the margin of the right valve is observed in the middle part on the ventral border where the overlap is greatest. On the anterior and posterior ends the two valves meet about evenly.

The surface of the shell is ornamented with small indistinct pits covering the entire carapace. Along the median line near the anterior end there is a group of small tubercles marking the position of the eye. These tubercles are small, low, and surround a small circular area.

Dimensions: maximum length: 1.48 mm.
maximum height: 1.16 mm.
maximum thickness: .81 mm.

This species may be distinguished from other species with which it might be confused by its sub-circular outline and by its protuberant right valve at the hinge line.

Holotype: Carnegie Museum No. 6482.

Horizon and locality: Nineveh Limestone at Nineveh, Pennsylvania.

Whipplella magnitata n. sp. (Plate XXV, fig. 2)

Carapace sub-rhomboidal in outline; in dorsal view elliptical. Greatest length below the median line; greatest height about the middle; greatest thickness along the median line in front of the center. Anterior cardinal angle sharp; posterior cardinal angle rounded. The posterior end is evenly rounded; anterior end truncated. Both dorsal and ventral margins are slightly convex.

The left valve is the larger and overlaps the right on all sides except along the hinge line where the right valve overlaps the left.

The surface of the carapace is smooth. A large, nearly circular spot below the median line and posterior to the center marks the position of the adductor muscle. This spot is darker than the rest of the carapace.

Dimensions: maximum length: 1.74 mm.
maximum height: .99 mm.
maximum thickness: .66 mm.

Whipplella magnitata n. sp. somewhat resembles *Whipplella deltoidea* n. sp. but differs from it by its greater length, more truncated

anterior end, longer hinge line, and lack of any surface ornamentation. From *Whipplella ninevehensis* n. sp., described later in this paper, it may be distinguished by its lesser thickness, greater length, longer hinge line, and smooth surface.

Holotype: Carnegie Museum No. 6487.

Horizon and locality: Nineveh Limestone at Nineveh, Pennsylvania.

***Whipplella ninevehensis* n. sp.** (Plate XXV, fig 3)

Outline of the carapace ovate; dorsal view elliptical. Greatest length below the median line; greatest height about the middle; greatest thickness in front of the center. Anterior end truncated; posterior end evenly rounded. Posterior cardinal angle rounded; anterior cardinal angle sharp, about 120 degrees. Hinge line short and straight.

The left valve is the larger and overlaps the right along the ventral margin; along the hinge line the right valve overlaps the left. On the anterior and posterior ends the two valves meet each other about evenly.

Entire surface of the carapace is ornamented with small, shallow pits. The scar of the adductor muscle, just below the median line and posterior to the center, is seen through the shell as a darker colored spot.

Dimensions: maximum length: 1.07 mm.
maximum height: .67 mm.
maximum thickness: .53 mm.

Whipplella ninevehensis n. sp. resembles *Whipplella magnitata* n. sp. by having a truncated anterior end but is easily distinguished from that species by its greater width and greater thickness. From *Whipplella deltoidea* n. sp. this species may be distinguished by its lesser dorsal overlap and its more elongate outline.

Holotype: Carnegie Museum No. 6483.

Horizon and locality: Nineveh Limestone at Nineveh, Pennsylvania.

***Whipplella parvula* n. sp.** (Plate XXV, fig. 6)

Carapace small, sub-elliptical in side view; dorsal view ovate. Greatest length below the median line; greatest height about the middle; greatest thickness along the median line in front of the center. Anterior and posterior cardinal angles about equal. Dorsal margin arched; ventral margin broadly rounded.

The left valve is the larger and overlaps the right on all sides except at the hinge line where the right valve overlaps the left. The hinge has a length of about one-third that of the shell.

The carapace is unornamented.

Dimensions: maximum length: .59 mm.
 maximum height: .38 mm.
 maximum thickness: .31 mm.

Whipplella parvula n. sp. is the most common species of this genus. It has also a wider geographic distribution as it is found in the Nineveh Limestone in both West Virginia and Pennsylvania. From other species of the same genus it is easily distinguished by its small size, its inflated anterior end, and the absence of ornamentation.

Holotype: Carnegie Museum No. 6489.

Horizon and locality: Nineveh Limestone at Nineveh, Pennsylvania and at Limestone Hill, West Virginia.

Whipplella ovata n. sp. (Plate XXV, fig. 4)

The outline of the carapace in side view is sub-elliptical. Greatest length below the median line; greatest height in front of the center; greatest thickness along the median line on the anterior ends of the valves. Anterior end broadly rounded; posterior end slightly rounded. The dorsal margin is broadly rounded; ventral margin slightly convex, tending to parallel the dorsal margin. The hinge line is straight and short, of a length of about one-fourth that of the carapace.

The left valve is the larger and overlaps the right on all sides except at the hinge line where the overlap is reversed.

The surface of the carapace is smooth. The position of the attachment of the adductor muscle, just posterior to the center, is marked in most specimens with a darker-colored spot.

Dimensions: maximum length: .78 mm.
 maximum height: .41 mm.
 maximum thickness: .34 mm.

Whipplella ovata n. sp. may be distinguished from the other smooth forms of this genus, *Whipplella magnitata* n. sp. and *Whipplella parvula* n. sp., by its rather pointed posterior end and its concave ventral border.

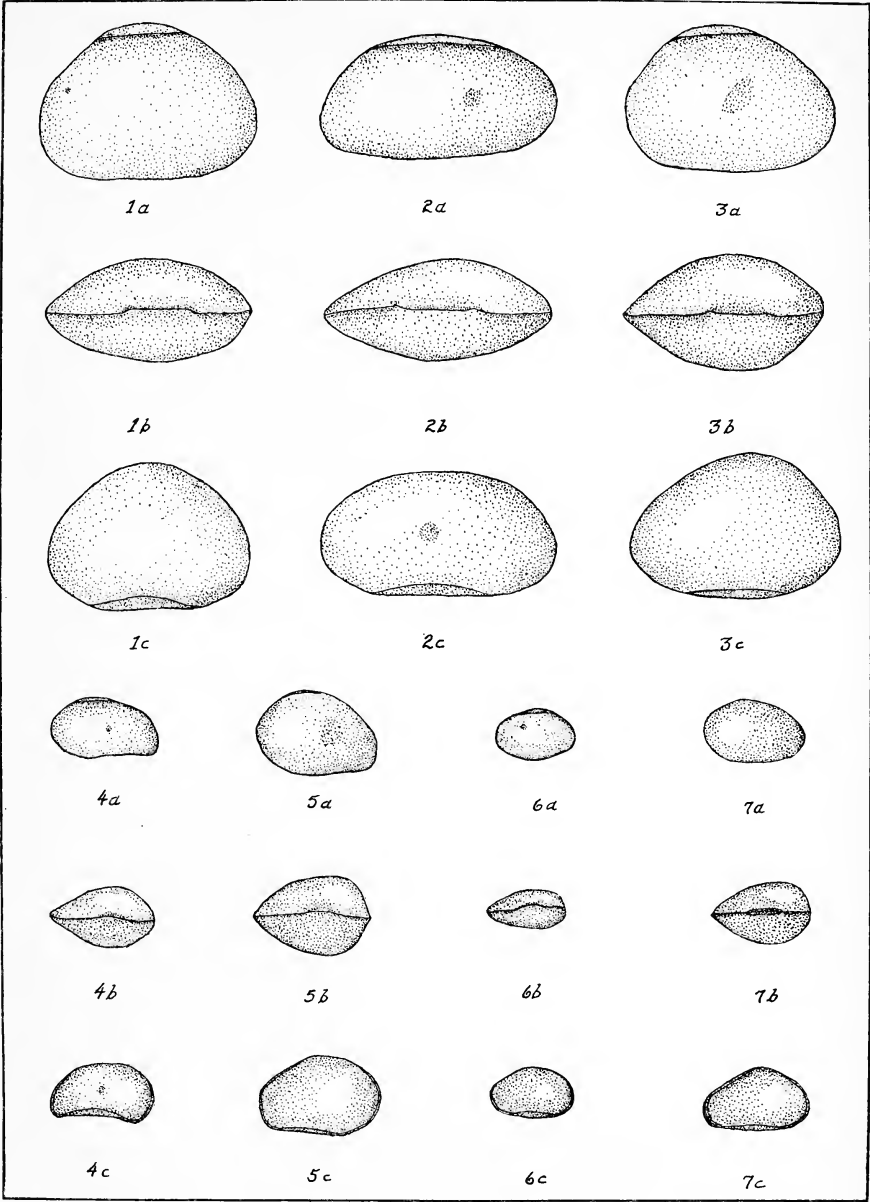
Holotype: Carnegie Museum No. 6485.

Horizon and locality: Nineveh Limestone at Nineveh, Pennsylvania.

EXPLANATION OF PLATE XXV.

(All figures magnified 18 times).

1. *Whipplella deltoidea* n. sp. 1a. Left valve. 1b. Dorsal view. 1c. Right valve.
Carnegie Museum No. 6482.
2. *Whipplella magnitata* n. sp. 2a. Left valve. 2b. Dorsal view. 2c. Right valve.
Carnegie Museum No. 6487.
3. *Whipplella ninevehensis* n. sp. 3a. Left valve. 3b. Dorsal view. 3c. Right
valve.
Carnegie Museum No. 6483.
4. *Whipplella ovata* n. sp. 4a. Left valve. 4b. Dorsal view. 4c. Right valve.
Carnegie Museum No. 6485.
5. *Whipplella cuneiformis* n. sp. 5a. Left valve. 5b. Dorsal view. 5c. Right
valve.
Carnegie Museum No. 6493.
6. *Whipplella parvula* n. sp. 6a. Left valve. 6b. Dorsal view. 6c. Right valve.
Carnegie Museum No. 6489.
7. *Whipplella depressa* n. sp. 7a. Left valve. 7b. Dorsal view. 7c. Right valve.
Carnegie Museum No. 6491.



VIII. NEW TITANOTHERES FROM THE UINTA EOCENE IN UTAH

BY O. A. PETERSON*

Professor O. C. Marsh in 1875 was the first to describe a horned titanothere from the Uinta Eocene, although he was not aware of that fact. The type of *Diplacodon elatum*, in the Peabody Museum of Natural History in New Haven, consists of a crushed palate with the cheek-teeth well represented. From this specimen Marsh was able to observe that the cheek-dentition was advanced towards the stage attained by the Oligocene titanotheres, but unable, due to the incompleteness of his material, to detect in his Eocene genus *Diplacodon* the extraordinary anatomical feature of heavy fronto-nasal horn-cores which are so characteristic of all known titanotheres of the White River Oligocene formation. In his original description Marsh appears to be of the opinion that *Diplacodon* has no horns.¹ In 1890 Osborn described a portion of a titanothere skeleton found by the Princeton field party in the Uinta sediments which he referred to *Diplacodon elatum* Marsh.² In this publication Osborn expressed his belief that the skull of *Diplacodon* "will show the initial development of the great horns of *Titanotherium*." To the Princeton University in general and to Mr. J. B. Hatcher in particular goes the credit of the first surprising discovery of the true horned Oligocene-type titanotheres in the Uinta Eocene. In the American Naturalist, Vol. XXIX, 1895, p. 1084, December issue, Hatcher described *Diplacodon emarginatum* and proposed for this new species his generic name *Protitanotherium*, "should future discoveries show that there are hornless forms with the same dental characters as *Diplacodon*." In Osborn's exhaustive study upon the titanotheres on pages 176 and 374 of Vol. I, *op. cit.* he ac-

*The critical illness and untimely death of the author prevented him from reading the proof of this paper.

¹Amer. Jour. Sci. Vol. IX, 1875, pp. 246-247.

²Trans. Amer. Philos. Soc., Vol. XVI, 1890, p. 514. On pp. 150, 653 of Vol. I of Osborn's *Titanotheres of Ancient Wyoming, Dakota and Nebraska*, U. S. Geol. Surv., Monograph 55, it appears that he regards these early Princeton specimens as "of uncertain generic and specific references."

cepts and amplifies Hatcher's description of *Protitanotherium*. In 1913 Peterson described a horned titanotherium (*Eotitanotherium osborni*) from the base of horizon C, or the upper part of horizon B, of the Uinta Eocene sediments of Utah. The principal generic distinction of *Eotitanotherium* was based on the premolar dentition, which is of an unusually advanced stage for a titanotherium in the upper part of horizon B of the Uinta sediments. Osborn on p. 196, Vol. I, of the *Titanotheres of Ancient Wyoming, Dakota and Nebraska*, regards the genus *Eotitanotherium* as doubtfully separated from *Diplacodon* Marsh. On pp. 434-435 of the same volume, Osborn, after closely comparing *Eotitanotherium* with *Diplacodon*, places the two latter genera in his subfamily *Diplacodontinae*, and has this to say: "On the other hand, the type of *E. osborni* appears to represent a distinct species or even a different genus from *D. elatus*, for although it comes from a lower geological level (Uinta B₂) its premolars are decidedly more progressive in characters, p³, p⁴ having the tetartocones larger and more separated from the deutocones, the external and internal cingula reduced, and the whole appearance of the crown more molari-form than in *D. elatus*." As no additional material of this genus has yet been discovered in the same geological horizon in which *Eotitanotherium* was found, this question of whether or not we are to regard *Diplacodon* and *Eotitanotherium* as congeneric may well rest in abeyance.

In the abundant material of horned titanotheres in the Carnegie Museum from higher levels in horizon C of the Uinta sediments, we discover now that the genus *Diplacodon* is very well represented. Recent comparative and minute study of the type specimen in the Peabody Museum, New Haven, leaves no room for doubt that we have in this higher horizon an advanced species of the genus *Diplacodon* which may be named:

***Diplacodon progressum* sp. nov.**

PLATES XXVI-XXVII

Holotype: Skull with lower jaws associated, C. M. No. 11879A; eleven dorsal vertebræ, the lumbar series, sacrum and pelvis all found articulated; several ribs, 1 humerus, the right and left femora, one tibia and parts of fore and hind feet, C. M. No. 11879, were found close to and are associated with the holotype.

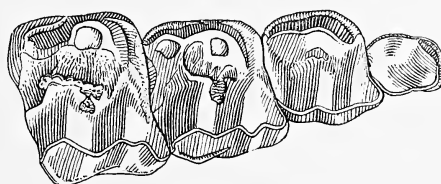
Paratype: Skull very nearly complete. C. M. No. 11881.

Geological Horizon: Uinta Eocene; upper series of horizon C.

Locality: "Skull Pass" Quarry on Green River, seven miles above Ouray, Uinta Co., Utah.

Generic Characters.—Osborn in his *Titanotheres of Ancient Wyoming, Dakota and Nebraska* Vol. I, p. 439, has defined the genus *Diplacodon* as follows: "Skull mesaticephalic to dolicocephalic; zygomatic arches slender. Superior premolars with flattened ectolophs and double convexities; p^{2-4} progressive, quadritubercular—that is, with tetartocone; molars of elongate or dolicocephalic type—that is, laterally compressed." To Osborn's definition may now be added: Nasals well developed and curved downward at the tips; fronto-nasal horn-cores well developed in the males, with elongate oval bases; top of skull saddle-shaped with high and broad occiput as is the case in the lower White River oligocene titanotheres.

Specific Characters.—So far as comparison may be made between the present new species and the holotype of *D. elatum* it is quite clear that the facial region is shorter in *D. progressum*, because the premolar series is relatively shorter. Furthermore the premolar series in the new species is farther advanced in molarization than in *D. elatum*, the individual teeth being more perfectly quadrate in *D. progressum*, P^2 being especially advanced from that in the species from the earlier horizon.



Upper premolars of *Diplacodon progressum*.

C. M. No. 11879A (Two-thirds natural size)

If we may be permitted to make a few comparisons between *Eotitanotherium osborni* and the new species here proposed; or, it may be better to say, if it should develop that *Eotitanotherium* is, after all, congeneric with *Diplacodon*, we have a number of important anatomical differences between the two forms, of which the following may be mentioned: In *D. progressum* the nasals, though similar to those in *E. osborni*, are shorter and heavier, and the alveolar border of the premaxillary is noticeably shorter.

The lower jaws of the holotype are shortened by a fore-and-aft crushing in the region of the symphysis so that the part bearing the

premolars appears unusually short. The individual premolar teeth are, however, relatively short and broad when compared with those in *E. osborni*. M_3 in *D. progressum* is also shorter than the corresponding tooth in *E. osborni*.

MEASUREMENTS

| SKULL | HOLOTYPE | PARATYPE |
|---|------------|-----------|
| | No. 11879A | No. 11881 |
| Tip of nasals to occiput, median line..... | 555 mm. | 525*mm. |
| Tip of nasals to anterior base of horn-cores..... | 108*mm. | 108*mm. |
| Transverse diameter across the tips of the horn-cores.... | 290 mm. | 292 mm. |
| Transverse diameter at greatest expanse of the zygomatic arches | 405 mm. | |
| Transverse diameter at occipital plate | 240 mm. | 235 mm. |
| Incisor teeth to occipital condyles..... | 580 mm. | 581 mm. |
| I^1 to and including M^3 | 298 mm. | 298*mm. |
| Diastema between canine and P^1 | 22 mm. | 22 mm. |
| Length of cheek dentition..... | 227 mm. | 225 mm. |
| Length of premolar series..... | 83 mm. | 85 mm. |
| Length of molar series..... | 147 mm. | 142 mm. |
| Length of P^1 | 16 mm. | 16 mm. |
| Transverse diameter of P^1 | 12 mm. | 12*mm. |
| Antero-posterior diameter of P^2 , external measurement | 20 mm. | 21 mm. |
| Median measurement P^2 | 20 mm. | 21 mm. |
| Internal measurement P^2 | 19 mm. | 18 mm. |
| Transverse diameter of P^2 , median body of the tooth.... | 23 mm. | 23 mm. |
| Antero-posterior diameter of P^3 | 23 mm. | 24 mm. |
| Transverse diameter of P^3 | 27 mm. | 29 mm. |
| Antero-posterior diameter of P^4 | 26 mm. | 27 mm. |
| Transverse diameter of P^4 | 33 mm. | 35 mm. |
| Antero-posterior diameter of M^1 | 38 mm. | 36 mm. |
| Transverse diameter of M^1 | 41 mm. | 44 mm. |
| Antero-posterior diameter of M^2 , external measurement | 58 mm. | 50 mm. |
| Antero-posterior diameter of M^2 , median measurement | 51 mm. | 47 mm. |
| Transverse diameter of M^2 | 52 mm. | 52 mm. |
| Antero-posterior diameter of M^3 , external measurement. | 64 mm. | 63 mm. |
| Antero-posterior diameter of M^3 , median measurement | 58 mm. | 53 mm. |
| Transverse diameter of M^3 | 54 mm. | 54 mm. |

| LOWER JAWS | HOLOTYPE |
|---|------------|
| | No. 11879A |
| Total length of the jaw fragment..... | 410 mm. |
| Inferior border of angle to top of coronoid process..... | 265 mm. |
| Inferior border of angle to top of articulating condyle.... | 217 mm. |
| Depth of ramus at M_3 , internal measurement..... | 87 mm. |

*Approximate measurements.

| | |
|--|--------|
| Depth of ramus at P ₄ , internal measurement..... | 72 mm. |
| Length of P ₃ | 23 mm. |
| Greatest transverse diameter of anterior crescent P ₃ | 13 mm. |
| Greatest transverse diameter of posterior crescent P ₃ | 16 mm. |
| Antero-posterior diameter of P ₄ | 25 mm. |
| Greatest transverse diameter of anterior crescent P ₄ | 16 mm. |
| Greatest transverse diameter of posterior crescent P ₄ | 18 mm. |
| Antero-posterior diameter of M ₁ | 37 mm. |
| Greatest transverse diameter of anterior crescent M ₁ | 21 mm. |
| Greatest transverse diameter of posterior crescent M ₁ | 24 mm. |
| Antero-posterior diameter of M ₂ | 47 mm. |
| Greatest transverse diameter of anterior crescent M ₂ | 26 mm. |
| Greatest transverse diameter of posterior crescent M ₂ | 29 mm. |
| Antero-posterior diameter of M ₃ | 69 mm. |
| Greatest transverse diameter of anterior crescent M ₃ | 28 mm. |
| Greatest transverse diameter of posterior crescent M ₃ | 26 mm. |
| Greatest transverse diameter of heel M ₃ | 18 mm. |

When the great mass of titanotheres material from the "Skull Pass Quarry" on Green River, Utah, is taken out and extracted from the matrix in the laboratory, a full report upon the osteology of *Diplacodon progressum* will be published, together with that of other forms which may occur in the quarry.

THE SUBFAMILY TELMATHERIINÆ OSBORN.

STHENODECTES GREGORY.

After a very careful comparison with the holotype of *Sthenodectes* in the Carnegie Museum and also with the published results of studies on the Eocene titanotheres by Osborn and Gregory³ it is very evident that a skull and the lower jaws found articulated in horizon A of the Uinta Eocene sediment by Mr. J. LeRoy Kay, of the Carnegie Museum Field Party, 1927, is to be referred to that genus. The specimen answers most closely to the generic characters given in Osborn's work on the titanotheres (*op. cit.*, p. 353) except for the presence of the "fronto-nasal horn swellings" in the specimen before us which may here be regarded as characteristic of the male.

That the genera *Telmatherium* and *Sthenodectes* are very closely related, is especially evident when the form of *Sthenodectes* found in the lower Uinta is compared with *Telmatherium vallidens* and *T. cultridens* of the Bridger sediments. However, the relatively shorter facial region and the macrodont incisor series of *Sthenodectes*, together with other less noticeable characters of the dentition, are here regarded as of such anatomical importance that it seems prudent to continue to treat the two lines represented by the genera *Sthenodectes* and *Telmatherium* as distinct.

***Sthenodectes priscus* sp. nov.**

PLATES XXVIII

Holotype: Skull and lower jaws. C. M. No. 11437.

Horizon: Uinta Eocene; horizon A.⁴

Locality: Willow Creek, Uinta County, Utah.

Specific Characters: Upper canine of rounder cross-section at the base of the crown and with posterior cingulum less developed than in *S. incisivus*; cheek-dentition less hypsodont and cingula less developed than in *S. incisivus*. A short diastema present back of the upper canine, but absent in *S. incisivus*.

³"Titanotheres of Ancient Wyoming, Dakota and Nebraska"; U. S. Geol. Surv. Monograph 55, Vol. I, 1929; Science, Vol. XXXV, 1912, p. 546.

⁴The first twenty feet of heavily bedded sandstone above the Green River Shale, recorded on p. 301 and Pls. X and XI in the paper by Peterson and Kay, on the "Upper Uinta Formation of Northeastern Utah" (Ann. Carn. Mus., Vol. XX, 1931) is the exact geological horizon from which this holotype came.



Lower teeth of *Sthenodectes priscus* Peterson
C. M. No. 11437 (One-third natural size)



Upper teeth of *Sthenodectes priscus* Peterson.
C. M. No. 11437 (One-third natural size)

The skull of the holotype of *Sthenodectes* is not distorted by crushing but, unfortunately, the greater part of the zygomatic arches, the premaxillaries, and the tips of the nasals are absent. The basicranial region was also apparently partly destroyed before the final interment of the specimen. The lower jaws are more completely preserved and were found articulated with the cranium.

Like those of *S. incisivus*, the nasals are evidently short, tapering rapidly in front, with the naso-maxillary notch on a line with the interval between the canine and P^1 , and the nasals are much broader posteriorly at the point where they are received by the frontals. The dorsal face of the nasals is convex from side to side along the posterior median line and concave along the lateral borders. The fronto-nasal "horn swellings" are prominent, and this, as before stated, may well be a sexual character. The frontals are broad anteriorly, with heavier superior borders of the orbits than in *S. incisivus*, but, as in the latter, the post-orbital processes are heavy. The temporal line is light and it converges gradually to conform with the narrow parietals and thence backwards to the high and thin sagittal crest. As is the case in *S. incisivus*, the upper contour of the skull is saddle-shape with the highest anterior point at the fronto-nasal "horn-swellings." The face in front of the orbit is somewhat less concave than in *S. incisivus* which difference may, in part at least, be due to a crushing of the holotype of the latter species. The "lacrimal pit," which Douglass originally described in *S. incisivus*,⁵ is not present in the specimen here

⁵Ann. Carn. Mus., Vol. VI, 1909, p. 305.

described, which apparently strengthens Osborn and Gregory's supposition that these vacuities were formed by a crushing of the holotype of *S. incisivus*.⁶ The large infraorbital foramen is close to the orbits (18 mm.). In agreement with the species described by Douglass, there is no infraorbital shelf or protuberance of the malar, but a large postorbital process is present. The orbit is of well proportioned size and of a sub-diamond shape with the posterior acute angle bounded by the large postorbital processes of the frontal and malar bones. The palatine plates of the maxillaries are evenly concave from side to side, nearly rectilinear fore-and-aft, and the anterior border of the postnarial opening is opposite the posterior part of M². As stated above, the base of the skull is mutilated and of no service for description.

In the holotype of *S. priscus* the upper incisors are lost. The canine is large, and, as is the case in *S. incisivus*, the crown is long, but less angular postero- and antero-laterally and more nearly round in cross-section. P¹ is longer than broad, having on the front part of the crown a simple cone and back of this a large base. The whole of the crown is surrounded by a prominent cingulum except on the external anterior angle.⁷ The length and breadth of the premolars in the species here proposed agree fairly well with the corresponding dimensions in *S. incisivus*, as does, also, the detailed structure, except the more sharply rounded convexities on the external wall of the protocone, and the greater hypsodont feature and heavier cingula in *S. incisivus*. The dentition in *S. priscus* has received greater wear than that in *S. incisivus*, but this is fully considered in connection with the study of the relative hypsodont character.

The upper molars agree in most characters with those of *S. incisivus*: that is, by their diameters; by their detailed structure, including the absence of the hypocone on M³; and by the poorly developed cingula on the internal faces. The brachydont condition of the premolars already mentioned is observed in the molars in approximately an equal degree when compared with the somewhat more hypsodont molars in *S. incisivus*.

⁶"Titanotheres of Ancient Wyoming, Dakota and Nebraska"; U. S. Geol. Surv. Monograph 55, Vol. I, 1929, p. 354; Science, Vol. XXXV, 1912, p. 546.

⁷According to the illustration by Riggs, Field Mus. Geol. Ser., Vol. IV, 1912, Pl. XII, the specimen of *Sthenodectes* in the Field Museum in Chicago, has P¹ somewhat more rounded and the main cusp carried farther back on the crown, but the tooth appears to be surrounded by a basal cingulum.

Lower Jaw.—The side view of the lower jaw of *Sthenodectes incisivus*, as figured on Plate XII, in Riggs' paper, *op. cit.*, appears distinctly short and deep when compared with that of the specimen under description. Furthermore the measurement given of the lower canine on p. 39 in Riggs' publication indicates that the tooth in the new species here proposed is more nearly equal in transverse and antero-posterior diameters. On p. 354 of Osborn's *Titanotheres of Ancient Wyoming, Dakota and Nebraska*, Vol. I, the isolated lower jaws described by Riggs as *Sthenodectes incisivus* are included as material of that species. If the lower jaws in the Field Museum are to be regarded as of *S. incisivus*, it appears that the differences noted in the characters of both skull and jaws indicate the appearance of specializations of considerable importance from *S. priscus* of horizon A to *S. incisivus* of horizon B of the Uinta Eocene.

The presence of massive lower incisors in the holotype of *S. priscus* constitutes one of the main reasons for regarding the specimen as belonging to the genus *Sthenodectes*. They are much worn anteriorly, except I_3 of the left side. This tooth shows that the lower incisors of *S. incisivus* will prove to be much like those of the upper series when found associated; that is, with an anterior prominent tubercle and a large posterior base surrounded by a heavy cingulum thus differing from the incisors in *Telmatherium* which are more "acutely convergent or V-shaped." In the specimen under description the incisors gradually increase in size from the median to the lateral. The antero-posterior diameter of the crowns is greater than the transverse.

The size and shape of the lower canine is much like that of the upper. The crown is rounded in cross-section, long and recurved with the basal cingulum of nearly an equal development to that in the upper canine; less developed than in the upper canine in the holotype of *S. incisivus*; and perhaps also less than in the canine of the lower jaw described as *S. incisivus* by Riggs (*op.cit.*, fig. 3, Pl. XII).

Premolars.— P_1 is very little worn and has a rather high and pointed crown, the main cusp of which occupies the greater portion. In front of the apex the prominent crest terminates in a slight swelling at the base, while posteriorly the crest is extended a little farther down on the crown. There is little or no indication of a posterior basal cusp. On the antero-external angle there is a cingulum slightly indicated, while postero-externally and medially there is very slight evidence of it. There are shallow anterior and posterior fossæ on the internal face.

P₂ has a very high and large protoconid, the postero-external (= hypodonid) tubercle being relatively quite small and concave internally, while the anterior base presents a slight style. Judging from the illustration of *S. incisivus* by Riggs, that species appears to have P₂ further advanced. P₃ has a similar large, though somewhat less elevated, protoconid than on P₂ and the tooth is farther along on its way to molarization. The anterior base and especially the postero-external cusp is developed to a greater extent, giving the tooth a broader aspect. The internal crest, from the protoconid to the postero-internal angle, is of sufficient development to effect an enclosed fossa of considerable size in that region of the crown. As is the case with the preceding teeth (P₂ and P₃) the anterior portion of the crown of P₄ is higher than the posterior region. This tooth is, however, quite molariform, the postero-external angle of the crown being well developed and it has received considerable wear. The antero-internal angle is filled out to a greater degree than that in P₃ and the postero-internal fossa is similarly enclosed, but of larger size. The cingula of the premolars are confined to the antero and postero-external angles; the posterior one is carried forward slightly beyond the external fossa.

Lower molars.—The lower molars are well worn and correspond in every way to those of the upper series. The detailed structure of this series is quite similar to those illustrated by Riggs. The cingula on the internal faces of the molars are confined to the anterior portion, while externally, especially in M₂ and M₃, there is a more extensive development.

MEASUREMENTS.

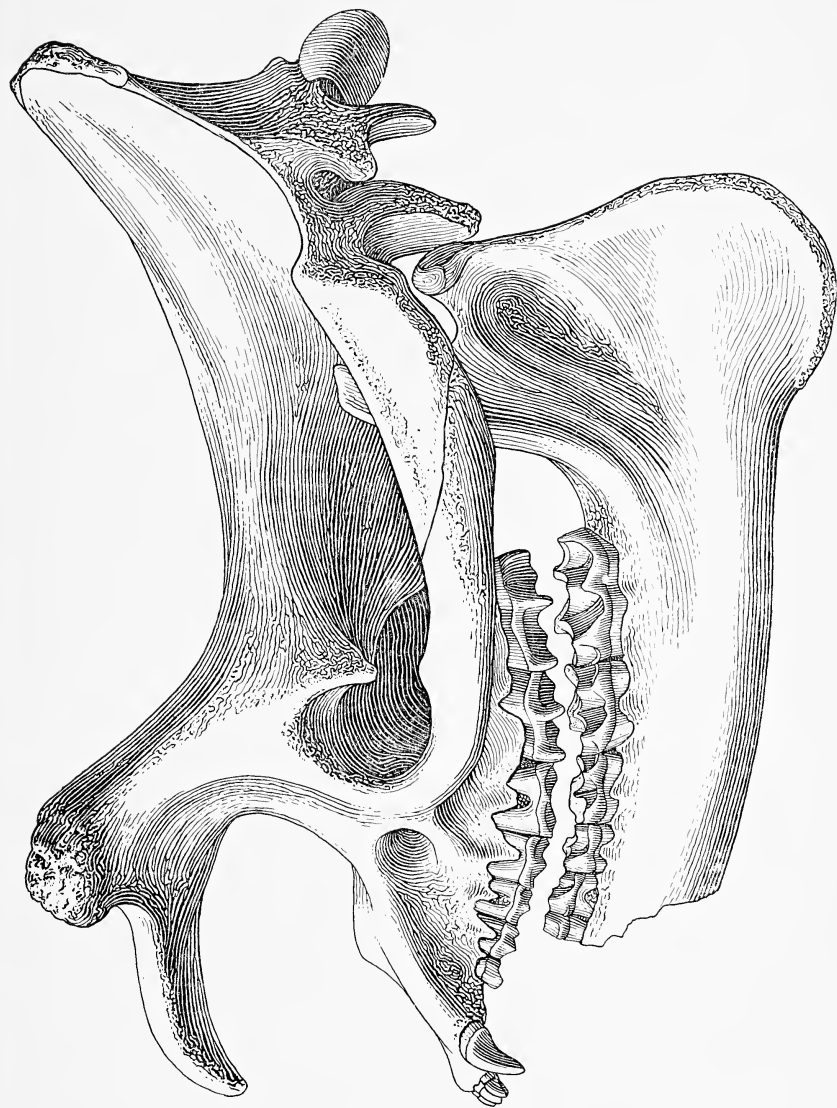
SKULL.

| | |
|--|---------|
| Basilar length, condyle to and including the canine..... | 415 mm. |
| Length from antorbital border to posterior border of infraorbital foramen. | 18 mm. |
| Transverse diameter of frontals at the orbits..... | 185 mm. |
| Transverse diameter of occipital plate..... | 150 mm. |
| Length of molar-premolar series..... | 198 mm. |
| Greatest antero-posterior diameter of canine at base..... | 26 mm. |
| Greatest transverse diameter of canine..... | 26 mm. |
| Length of premolar series..... | 58 mm. |
| Length of molar series..... | 124 mm. |
| Antero-posterior diameter of P ¹ | 16 mm. |
| Transverse diameter of P ¹ | 11 mm. |
| Antero-posterior diameter of P ² | 19 mm. |
| Transverse diameter of P ² | 23 mm. |
| Antero-posterior diameter of P ³ | 23 mm. |

| | |
|---|--------|
| Transverse diameter of P ³ | 30 mm. |
| Antero-posterior diameter of P ⁴ | 23 mm. |
| Transverse diameter of P ⁴ | 34 mm. |
| Antero-posterior diameter of M ¹ | 34 mm. |
| Transverse diameter of M ¹ | 42 mm. |
| Antero-posterior diameter of M ² | 43 mm. |
| Transverse diameter of M ² | 51 mm. |
| Antero-posterior diameter of M ³ | 48 mm. |
| Transverse diameter of M ³ | 49 mm. |

LOWER JAW.

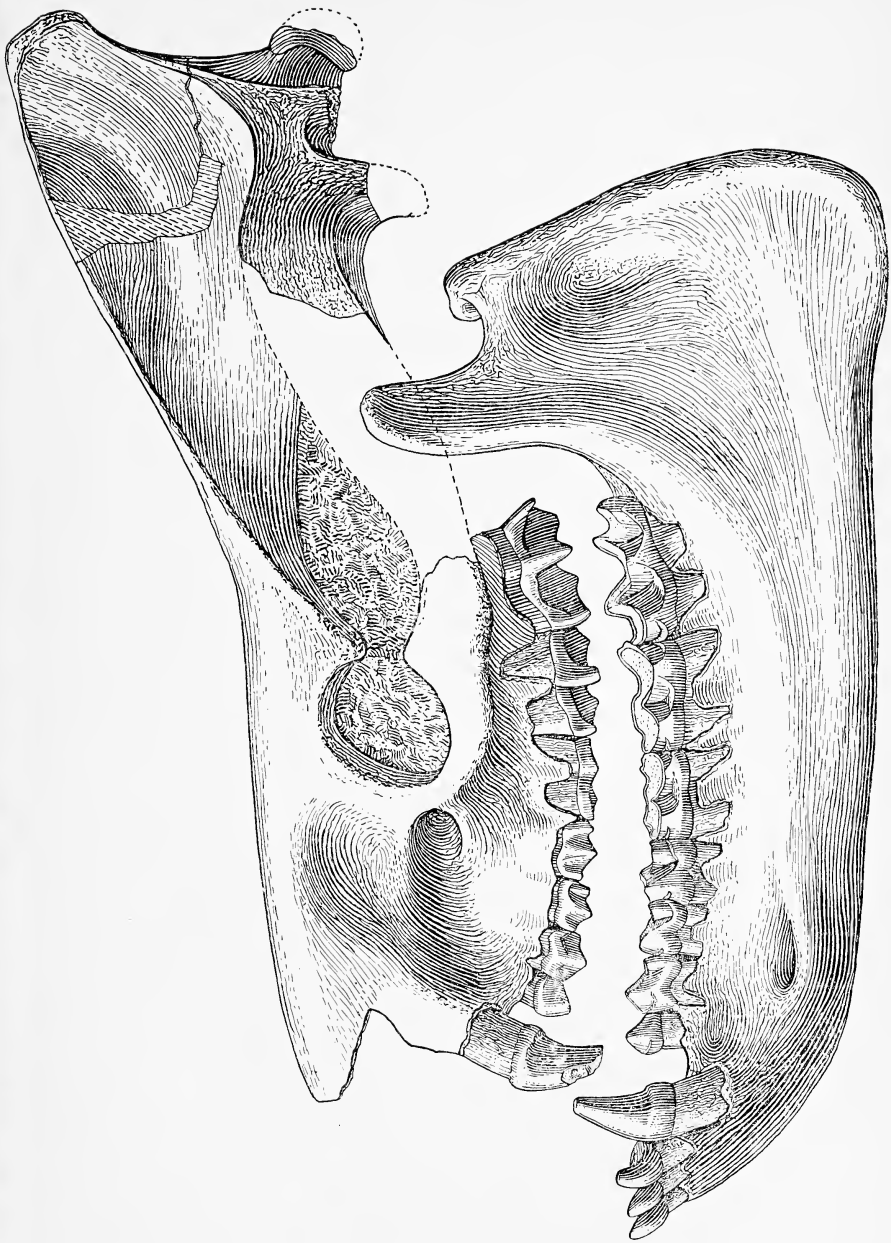
| | |
|---|---------|
| Greatest length of ramus, angle to and including incisors..... | 430 mm. |
| Depth of ramus at P ₁ | 60 mm. |
| Depth of ramus at M ₁ | 68 mm. |
| Depth of ramus at M ₃ | 82 mm. |
| Length of molar-premolar series..... | 217 mm. |
| Length of premolar series..... | 83 mm. |
| Length of molar series..... | 132 mm. |
| Antero-posterior diameter of I ₁ at the base of crown..... | 19 mm. |
| Transverse diameter of I ₁ | 13 mm. |
| Antero-posterior diameter of I ₃ | 21 mm. |
| Transverse diameter of I ₃ | 17 mm. |
| Antero-posterior diameter of canine at the base of crown..... | 24 mm. |
| Transverse diameter of canine..... | 22 mm. |
| Antero-posterior diameter of P ₁ | 17 mm. |
| Transverse diameter of P ₁ | 10 mm. |
| Antero-posterior diameter of P ₂ | 21 mm. |
| Transverse diameter of P ₂ | 15 mm. |
| Antero-posterior diameter of P ₃ | 21 mm. |
| Transverse diameter of P ₃ | 18 mm. |
| Antero-posterior diameter of P ₄ | 25 mm. |
| Transverse diameter of P ₄ | 21 mm. |
| Antero-posterior diameter of M ₁ | 33 mm. |
| Transverse diameter of M ₁ | 25 mm. |
| Antero-posterior diameter of M ₂ | 41 mm. |
| Transverse diameter of M ₂ | 30 mm. |
| Antero-posterior diameter of M ₃ | 58 mm. |
| Transverse diameter of M ₃ | 29 mm. |



Side view of skull and lower jaw of *Diplacodon progressum*.
C. M. No. 11879A (One-fourth natural size)



Palatal view of skull of *Diplacodon progressum*.
C. M. No. 11879A (One-fourth natural size)



Side view of skull of *Sthenodectes priscus* Peterson.
C. M. No. 11437 (One-third natural size)

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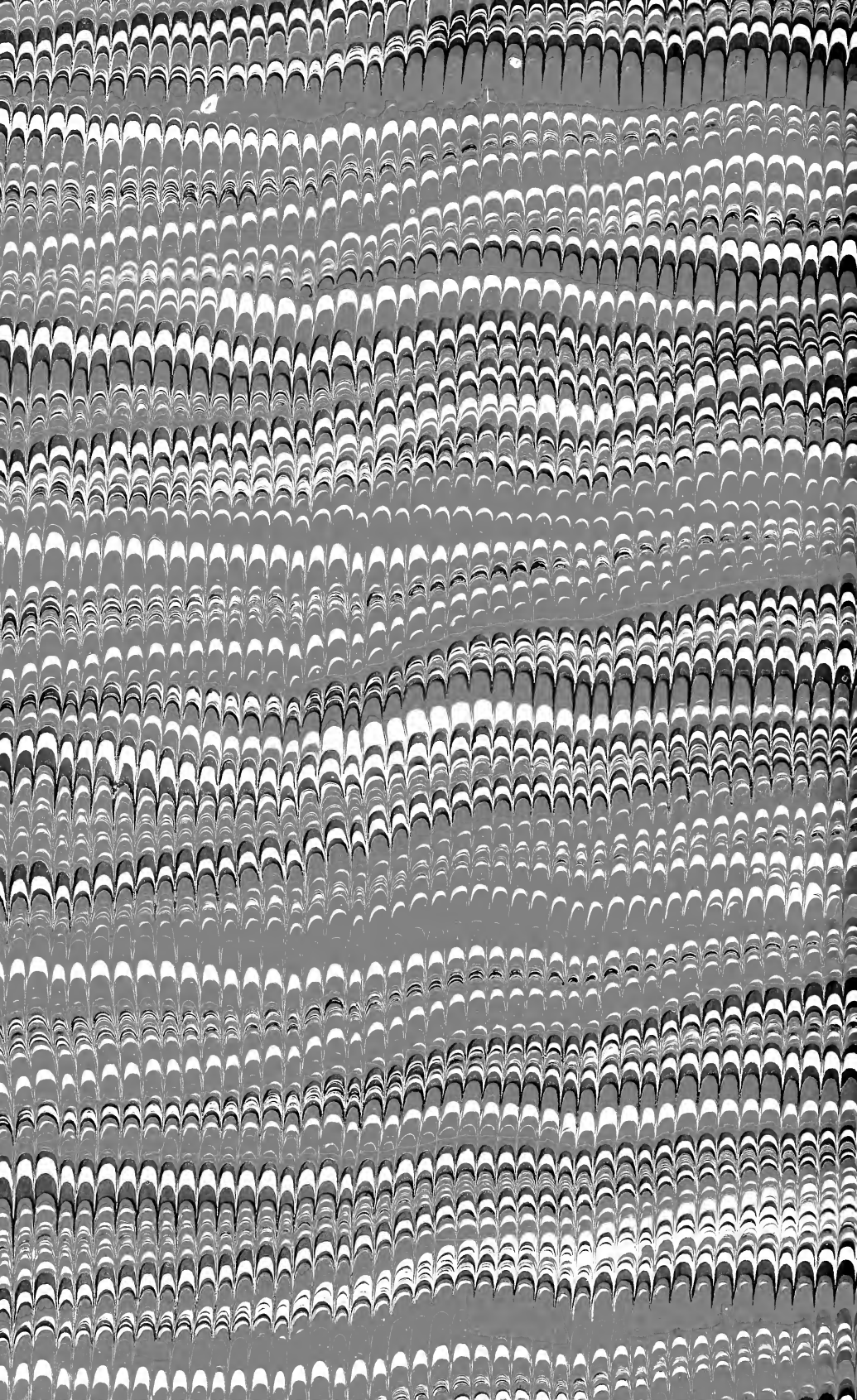
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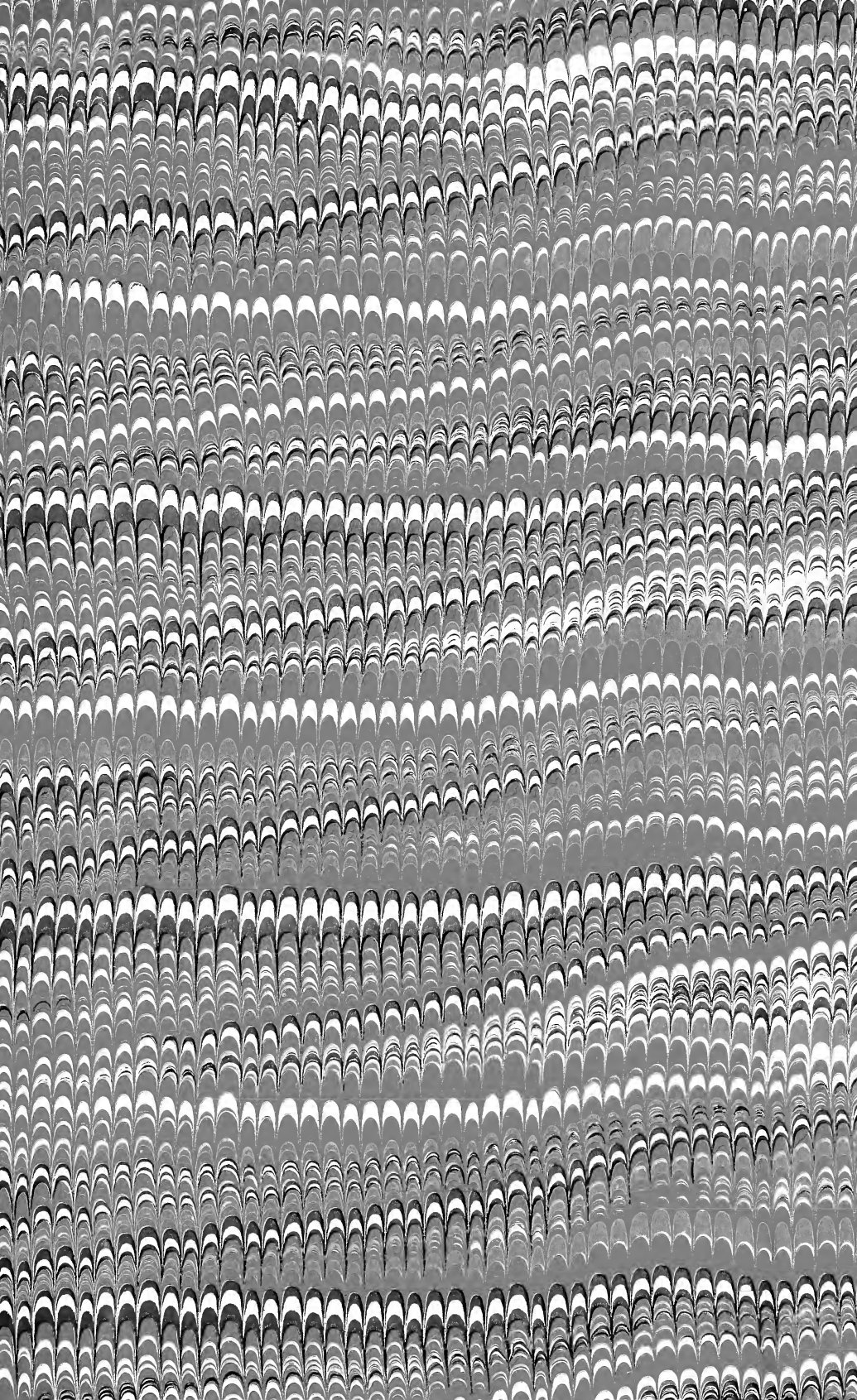
V. Sterki

O. A. Peterson

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